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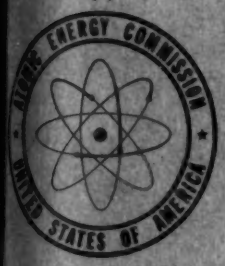

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NUCLEAR SCIENCE ABSTRACTS

Volume 10 October 31, 1956 No. 20

GENERAL

ATOMIC BOMBS AND WARFARE

9027
NUCLEAR RADIATION AT HIROSHIMA AND NAGASAKI. Robert R. Wilson (Cornell Univ., Ithaca, N. Y.). Radiation Research 4, 349-59(1956) May.

Data are reviewed on the radiation dosage due to neutrons and γ-rays from atomic explosions received by residents of Hiroshima and Nagasaki. (C.H.)

ATOMIC POWER

9028
THE INDIAN POINT PROJECT. Atomics 7, 178-80 & 182 (1956) May.

Consolidated Edison's Indian Point project to be built by 1960 is described. The reactor will be a pressurized water U–Th converter and will be equipped with Th elements for partial conversion of Th to U^{233}. (F. S.)

9029
THE ECONOMICS OF NUCLEAR POWER. J. M. Kay. Nuclear Eng. 1, 54-5(1956) May.

Calculations are made on the cost of nuclear power generated in a large graphite-moderated, gas-cooled reactor. It is probable that the cost will be equivalent to that from conventional means. Nuclear power is subject to considerable uncertainties until experience has been gained by actual means. (F.S.)

RESEARCH PROGRAMS

9030 NP-5960
American Consulate General, Frankfurt Am Main. Science Div.
GERMAN SCIENCE BULLETIN NO. 1. Apr. 1956. 22p.

Scientific studies in the field of atomic energy and related fields being carried out in West Germany at the present time are briefly reviewed. The role of private industry in scientific research, problems in the German universities, and aircraft research in Germany are discussed briefly. (C.H.)

9031
INDIA'S MINERAL POTENTIALITY FOR ATOMIC ENERGY. D. N. Wadia. J. Sci. Ind. Research (India) 15A, 159-64(1956) Apr.

BIOLOGY AND MEDICINE

9032 AERE-SPAR-2
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE METABOLISM OF STRONTIUM IN MAN. PAPER NO. 2. G. E. Harrison, W. H. A. Raymond, and Helen C. Tretheway. July 1955. 18p.

9033 UCLA-375
California. Univ., Los Angeles. Atomic Energy Project.
ACUTE PULMONARY EDEMA ASSOCIATED WITH HEAD INJURY IN HUMANS. B. Cassen, H. Kade, and W. Gutfreund. July 23, 1956. 14p. Contract AT-04-1-GEN-12. $3.30(ph OTS); $2.40(mf OTS).

Autopsy records of accidental deaths were made available for a study of the association of head injury and pulmonary edema. Two hundred forty-seven cases of traffic fatalities were selected from a recent series of 12,500 consecutive coroner's cases. Those complicated by thoracic trauma and several other specific diseases were eliminated. Also, those surviving over 100 hours were excluded. Of the 247 selected cases, 229 showed head injury and 189 showed either pulmonary edema or congestion. In 173 cases there were findings of pulmonary edema or congestion concomitant with head injury. The results support the hypothesis that hypothalamic concussion may be a mechanism for the production of acute pulmonary edema in humans. This hypothesis is in accord with previously reported animal experiments which indicate that acute pulmonary edema is mediated by certain disturbances of hypothalamic function. (auth)

9034
THE EFFECT OF n-METHYL-PHENYL-ETHYL BARBITURIC ACID ON THYROID FUNCTION IN THE RAT. C. J. Shellabarger (Brookhaven National Lab., Upton, N. Y.). Endocrinology 58, 347-51(1956) Mar.

9035
RESPIRATION OF THE PEA PLANT. METABOLISM OF HEXOSE PHOSPHATE AND TRIOSE PHOSPHATE BY CELL-FREE EXTRACTS OF PEA ROOTS. Martin Gibbs, Joan M. Earl, and Jean L. Ritchie (Brookhaven National Lab., Upton, N. Y.). Plant Physiol. 30, 463-7(1955) Sept.

Refer also to abstract 9176.

RADIATION EFFECTS

9036 NM-006 012.04.99
Naval Dental School. National Naval Medical Center, Bethesda, Md. and Naval Medical Research Inst., Bethesda, Md.
HISTOLOGIC CHANGES IN THE INCISOR TEETH OR RATS SERIALLY SACRIFICED AFTER RECEIVING 1,500 r of 200 KV X-RAY IRRADIATION. Louis S. Hansen and James A. English. Dec. 27, 1955. 13p.

Fifty white rats were irradiated locally to the head with 1,500 r of 200 kv x-ray. These rats were serially sacrificed simultaneously with 50 littermate control rats at various intervals beginning at 16 hr following exposure. Examination of histologic sections of teeth revealed that the locus of radiation injury was principally within the young, metabolically active, functioning odontogenic layers of cells. It appeared that, even though this damaged tissue underwent severe retrogressive changes, the irradiation was not sufficient to destroy either the undifferentiated epithelial and mesenchymal cells, or those odontogenic cells that had completed their physiologic function. A second tooth was observed to arise from these surviving

undifferentiated cells of the tooth germ. The reason there were two separate segments of tooth arising from a single tooth germ was because of a severe interruption in tooth formation following radiation, and during the early recovery period abnormal tooth substance was formed. Finally relatively normal tooth structure was again formed by the odontogenic cells. (auth)

9037 NP-5964

Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 19. Apr. 15, 1956. 148p. Contract AF41(657)-25.

Progress is reported in an investigation of pharmacological and toxicological compounds as protective or therapeutic agents against radiation injury in experimental animals. Data are included on the effects of several thioctic acids, a number of unrelated chemical compounds, metabolic antagonists, cortical steroids, and thiourea on the mortality of mice and rats; the influence of time-intensity factors and dose fractionation on radiation mortality of rats and mice; the effects of whole-body x irradiation and starvation on the free amino acid content of rat plasma; the effect of environmental temperature on the radiosensitivity of rats; and the effects of environmental factors and whole-body x irradiation on citrate synthesis in rats. (For preceding period see NP-5877.) (C.H.)

9038 NP-6067

Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 20. July 15, 1956. 145p. Contract AF-41(657)-25.

Progress is reported in studies on the early effects of ionizing radiations on the adenosine triphosphatase activity of leukocytes isolated from peritoneal washings of normal and irradiated rats; the influence of continuous Co^{60} γ irradiation on the 5-nucleotidase activity of the spleens and thymus glands of rats; a comparison of the injurious effects of exposure of rats to various daily doses of Co^{60} γ radiation as measured by adenosine triphosphatase assays on hematopoietic tissues; determinations of the phosphatase activity of tissues of rats and mice after whole-body x irradiation; determination of the free amino acid content of the plasma of rats exposed to doses of 100 r to 1200 r of whole-body x irradiation; the influence of high temperature and other environmental factors on the susceptibility of animals to radiation injuries; and screening tests on various chemical compounds to ascertain their effect on the survival time, weight loss, and mortality of mice and rats exposed to lethal doses of whole-body x irradiation. (For preceding period see NP-5964.) (C.H.)

9039 PB-121103

Department of Commerce, Washington, D. C.
U. S. ARMY PANEL DISCUSSION ON RADIATION PRESERVATION OF FOOD. U. S. Department of Commerce Second Annual Atomic Energy Exhibition, April 17, 1956. 22p. $0.50(OTS).

The background and the present status of investigations on the radiation preservation of food are reviewed. Results to date indicate that radiation treatment will preserve food for prolonged storage in the fresh state without refrigeration. The irradiated foods are not toxic, harmful, or radioactive. Not all foods have been found to respond favorably from the color, odor, taste, and texture aspect, but even some of these, it appears, will yield to further research. Cost factors, design and fabrication of irradiation facilities, the effects of pasteurization and sterilization doses on various foods, and the problem of consumer acceptance are discussed briefly. (C.H.)

9040

ACUTE RADIATION DEATH OF DOGS RECEIVING A SINGLE MASSIVE DOSE OF INTRAVENOUS RADIOACTIVE GOLD. P. F. Hahn, Andrew H. Jackson, Frank E. Staggers, Marvin A. Jackson, and E. L. Carothers (Meharry Medical Coll., Nashville, Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1139-43(1956) June.

Nine young dogs with acute radiation death resulting from one massive intravenous dose of radioactive colloidal gold are presented. Most of the animals survived less than eleven days. Some histologic changes are noted and discussed. In addition to the marked leukopenia and lymphopenia, the monocytic series of cells was significantly depressed in these dogs. The anemia appeared early and was severe. Histologic evidence of liver damage was minimal in most animals. Marked hypoplasia or aplasia of the bone marrow was found in all animals. (auth)

9041

THE INTERRELATIONSHIPS BETWEEN ULTRAVIOLET IRRADIATION AND THE THERMAL REACTIVATION OF THE BACTERIUM, E. COLI B. Anne Buzzell (Univ. of Pittsburgh). Arch. Biochem. Biophys. 62, 97-108(1956) May.

9042

CHORIORETINAL LESIONS DUE TO THERMAL RADIATION FROM THE ATOMIC BOMB. V. A. Byrnes, D. V. L. Brown, H. W. Rose, and Paul A. Cibis (U.S.A.F. School of Aviation Medicine, Randolph AFB, Tex.). Arch. Ophthalmol. 55, 909-14(1956) June.

9043

TIME-INTENSITY FACTORS IN RADIATION RESPONSE. I. THE ACUTE EFFECTS OF MEGAVOLT ELECTRONS (CATHODE RAYS) AND HIGH- AND LOW-ENERGY X-RAYS WITH SPECIAL REFERENCE TO THE BRAIN. Samuel P. Hicks, Kenneth A. Wright, and Kenneth E. Leigh (New England Deaconess Hospital, Boston; Harvard Medical School, Boston; and Massachusetts Inst. of Tech., Cambridge, Mass.). Arch. Pathol. 61, 226-38(1956) Mar.

9044

THE EFFECTS OF X- AND γ-RADIATION ON NUCLEIC ACID METABOLISM IN THE RAT IN VIVO AND IN VITRO. Margery G. Ord and L. A. Stocken (Univ. of Oxford, England). Biochem. J. (London) 63, 3-8(1956) May.

9045

EFFECT IN SURFACE RIPENED CHEESE OF IRRADIATION ON SPORES AND TOXIN OF CLOSTRIDIUM BOTULINUM TYPES A AND B. R. O. Wagenaar and G. M. Dack (Univ. of Chicago). Food Research 21, 226-34(1956).

9046

IDENTIFICATION OF HALF-TRANSLOCATIONS PRODUCED BY X-RAYS IN DETACHING ATTACHED-X CHROMOSOMES OF DROSOPHILA MELANOGASTER. Seymour Abrahamson, Irwin H. Herskowitz, and H. J. Muller (Indiana Univ., Bloomington). Genetics 41, 410-19(1956) May.

9047

INDUCED CHANGES IN FEMALE GERM CELLS OF DROSOPHILA. I. DEPENDENCE OF HALF-TRANSLOCATION FREQUENCY UPON X-RAY DELIVERY RATE. Irwin H. Herskowitz and S. Abrahamson (Indiana Univ., Bloomington). Genetics 41, 420-8(1956) May.

9048

ON CERTAIN REGULARITIES IN BIOLOGICAL EFFECTS OF IONIZING RADIATION. G. S. Strelin (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, 27-35(1956) Jan.-Feb. (In Russian)

9049

IMMUNOLOGICAL ANALYSIS OF INCREASED STATE OF ORGANISM RESISTANCE TO IONIZING RADIATION. P. N. Kiselev, P. A. Busini, and K. I. Nikitina (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, 43-9(1956) Jan.-Feb. (In Russian)

9050
EFFECTS OF IONIZING RADIATION ON IMMUNITY TO INTESTINAL INFECTIONS. M. A. Tumanyan, and A. V. Izvekova (Gamaleĭ Inst. of Epidemiology and Microbiology). Med. Radiol. 1, 59-65(1956) Jan. – Feb. (In Russian).

9051
CERTAIN PECULIARITIES IN THE EFFECTS OF RADIOACTIVE SUBSTANCES IN ORGANISMS. D. I. Zakutinskiĭ. Med. Radiol. 1, 68-79(1956) Jan.-Feb. (In Russian)

9052
CHANGE IN SUPRARENAL ASCORBIC ACID CONTENT IN GUINEA PIGS FOLLOWING X RADIATION. L. Ya. Zhorno (Pavlov Leningrad Med. Inst.). Med. Radiol. 1, 79-81(1956) Jan.-Feb. (In Russian)

9053
REACTION OF THE HEART-VASCULAR SYSTEM TO THE EFFECTS OF IONIZING RADIATION. A. V. Lebedinskiĭ. Med. Radiol. 2, 3-9(1956) Mar.-Apr. (In Russian)

9054
ON THE EFFECTS OF IONIZING RADIATION ON THE ANTIGENIC PROPERTIES OF ALBUMEN. L. A. Zil'ber, V. A. Artamonova, G. M. Frank, and A. D. Snezhko (Gamalei Inst. of Epidemiology and Microbiology). Med. Radiol. 2, 17-23(1956) Mar.-Apr. (In Russian)

9055
EFFECTS OF REPEATED SMALL DOSE X RADIATIONS AS IMMUNIZATION MEASURE AGAINST TYPHOID FEVER BACTERIA. O. V. Chakhava (Gamlei Inst. of Epidemiology and Microbiology). Med. Radiol. 2, 29-32(1956) Mar.-Apr. (In Russian)

9056
ON THE EFFECTS OF IONIZING RADIATION ON THE NIDUS OF INFECTION AND ITS PROPHYLAXIS AND CURE (STUDY OF WHOOPING COUGH INFECTION). B. N. Sofronov (Inst. of Exp. Medicine). Med Radiol. 2, 33-40 (1956). Mar.-Apr. (In Russian)

9057
THE ABSORPTION OF CERTAIN ANTIBIOTICS FROM THE GASTRO-INTESTINAL TRACT INTO THE BLOOD DURING RADIATION SICKNESS. A. P. Duplishcheva (Gamaleĭ Inst. of Epidemiology and Microbiology). Med. Radiol. 2, 46-51 (1956) Mar.-Apr. (In Russian)

9058
MECHANISM OF INACTIVATION OF TOBACCO MOSAIC VIRUS BY X-RAYS. Max A. Lauffer, David Trkula, and Anne Buzzell (Univ. of Pittsburgh). Nature 177, 890(1956) May 12.

9059
EFFECT OF PRETREATMENT WITH DIHYDROXY-DIMETHYL PEROXIDE ON THE RATE OF MUTATIONS INDUCED BY X-RAYS. F. H. Sobels. Nature 177, 980-2(1956) May 26.

9060
EXPERIENCE OF IONIZING RADIATIONS. Ethel Browning. Nuclear Eng. 1, 63-5(1956) May.

A survey of ionizing radiation injuries in industry is given. Early sufferings provide a grave warning on the hazards of ionizing radiations and genetic problems associated with radiation. (F.S.)

9061
THE MUTATION OF LINKED MAIZE ENDOSPERM LOCI INDUCED BY THERMAL-NEUTRON, X-, GAMMA, AND ULTRAVIOLET RADIATION. Calvin F. Konzak and W. Ralph Singleton (Brookhaven National Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 42, 239-45(1956) May.

9062
METHEMOGLOBINEMIA INDUCED BY X-IRRADIATION. J. Raymond Klein (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 91, 630-2(1956) Apr.

9063
RADIATION-INDUCED ALTERATION OF FIBRINOGEN CLOTTING RATE AND CLOT LABILITY. Peter Rieser (Univ. of Pennsylvania, Philadelphia and Marine Biological Lab., Woods Hole, Mass.). Proc. Soc. Exptl. Biol. Med. 91, 654-7(1956) Apr.

9064
X-RAY-INDUCED DIVISION DELAY OF INDIVIDUAL YEAST CELLS. Victor W. Burns (Univ. of California, Berkeley). Radiation Research 4, 394-412(1956) May.

9065
RADIATION-INDUCED FECAL FAT FORMATION IN THE RAT. Margaret G. Morehouse and Ronald L. Searcy (Univ. of Southern California, Los Angeles). Science 123, 1032 (1956) June 8.

9066
RADIOIODINE STORAGE AND THYROID FUNCTION AFTER WHOLE-BODY IRRADIATION OF LIVING RATS. Gunther Barth and Friedrich Wolf. Strahlentherapie 99, 369-74 (1956) Mar. (In German)

Iodine^{131} storage after whole-body irradiation of rats under protective covering of the thyroid gland has been compared to storage in normal controls. The result is demonstrated by a curve of biphasic course showing that after an initial decrease (depending on the dose) of the storage to 40 or 65% of the norm there follows, in case of irradiation with 650 r, an increased storage lasting about 50 to 55 days with adult animals and about 25 days with juvenile ones. (auth)

9067
THE INFLUENCE ON TISSUE RESPIRATION OF X RADIATION. Helmut Pauly and Boris Rajewsky. Strahlentherapie 99, 383-6(1956) Mar. (In German)

The authors report on their researches on organs of mice (liver, renal cortex, spleen) to determine the dependence of tissue respiration on the applied x-ray dose. The results of the experiments have shown that only after doses ranging about 100,000 r the tissue respiration decreases perceptibly. The dose effect curves are clearly described by means of a formula gained through considerations of hit-theoretical and reaction-kinetic character. (auth)

RADIATION HAZARDS AND PROTECTION

9068 ANL-5574
Argonne National Lab., Lemont, Ill.
RADIATION SAFETY GUIDE. J. R. Novak, ed. June 1956. 74p. Contract W-31-109-eng-38. $0.75(OTS).

Work with radioactive substances may involve some danger, and safety precautions must be taken before the work is started. This Guide includes suggested precautions to provide adequate protection, as well as some general information concerning possible radiation hazards and the effects of radiation on the body. It also contains procedural information which will be an aid in coping with radiation safety problems as they occur. (auth)

9069 USNRDL-TR-94
Naval Radiological Defense Lab., San Francisco.
STUDY OF AIRBORNE ACTIVITY RESULTING FROM DECONTAMINATION OF SHIPS CONTAMINATED WITH RADIOACTIVE FALLOUT. P. Farma. May 22, 1956. 27p. Project NS 083-001.

9070
THE DANGER OF CANCER FROM THOROTRAST AS A DIAGNOSTIC MEDIUM. Earl Budin and J. Gershow-Cohen (Albert Einstein Medical Center, Philadelphia). Am. J.

Roentgenol. Radium Therapy Nuclear Med. 75, 1188-93(1956) June.

9071

RETENTION OF RADON DECAY PRODUCTS IN HUMAN LUNGS. Cestmir Jech (Czechoslovak Academy of Science, Prague). Arch. Ind. Health 13, 475-9(1956) May.

9072

THE HAZARDS FROM THE INCREASING USE OF IONIZING RADIATIONS: A SYMPOSIUM. I. THE CONTROL OF RADIOLOGICAL HAZARDS IN THE FUTURE DEVELOPMENT OF ATOMIC ENERGY. W. G. Marley (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Radiol. 29, 261-5(1956) May.

9073

THE HAZARDS FROM THE INCREASING USE OF IONIZING RADIATIONS: A SYMPOSIUM. II. THE DOSE TO OPERATOR AND PATIENT IN X-RAY DIAGNOSTIC PROCEDURES. G. M. Ardran (Univ. of Oxford, England). Brit. J. Radiol. 29, 266-9(1956) May.

9074

THE HAZARDS FROM THE INCREASING USE OF IONIZING RADIATIONS: A SYMPOSIUM. III. AN ATTEMPT TO ASSESS THE GENETIC CHANGES RESULTING FROM THE IRRADIATION OF HUMAN POPULATIONS. Alma Howard (Mount Vernon Hospital, Northwood, Middlesex, England). Brit. J. Radiol. 29, 270-3(1956) May.

9075

THE DOSE TO THE TRACHEA AND BRONCHI FROM THE DECAY PRODUCTS OF RADON AND THORON. A. C. Chamberlain and E. D. Dyson (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Radiol. 29, 317-25(1956) June.

9076

THE CALCULATION OF MAXIMUM PERMISSIBLE CONCENTRATIONS FOR LONG-LIVED RADIOISOTOPES. J. W. Healy (General Electric Co., Richland, Wash.). Radiation Research 4, 367-72(1956) May.

9077

THE EFFECT OF TRANSFUSIONS OF BLOOD SHOWING EXTREME LEUKOCYTOSIS ON SURVIVAL OF X-IRRADIATED MICE. C. C. Congdon, T. W. McKinley, Jr., H. Sutton, and P. Urso, Jr. (National Cancer Inst., Bethesda, Md. and Oak Ridge National Lab., Tenn.). Radiation Research 4, 424-34(1956) May.

9078

RESEARCH ON BIOLOGICAL PROTECTIVE SCREEN. PART XIII. THE EFFECT OF ENERGY-RICH PHOSPHATE AND PHOSPHORLATED VITAMIN ON THE RADIATION SENSITIVITY OF RATS AND MICE. Hanns Langendorff, Ruprecht Koch, and Ulrich Hagen. Strahlentherapie 99, 375-82(1956) Mar. (In German)

Refer also to abstract 9079

RADIATION SICKNESS

9079

ON THE MECHANISM OF THE PROPHYLACTIC ACTION OF CHRONIC HYPOXIA UPON RADIATION SICKNESS. Z. I. Barbashova (Laboratory of Evolutionary Fiziology). Doklady Akad. Nauk S.S.S.R. 107, 761-4(1956) Apr. 11. (In Russian)

Preliminary acclimatization of rats to chronic hypoxia increases their resistance to ionizing radiation. Comparative evaluations were made to determine the functions of various systems in irradiated animals, acclimatized to hypoxia, and in control animals. Data describing the activity of compensation reactions and the general tendencies of oxidation processes in irradiated organisms are discussed. The activity of the compensation reactions was detected by the resistance intensity to strong hypoxia. The consumption of oxygen during radiation sickness was studied to determine the character of oxidation processes. The investigations were made on male rats weighing 230 to 310 g. The rats were kept under 400 mm Hg barometric pressure at 7600 m "elevation". The weight, the consumption of oxygen, and the resistance to strong hypoxia were checked in acclimatized rats and in control ones after their exposure to γ rays from Co^{60}. The rats were given 1016r at the rate of 3.7r per minute. Resistance to hypoxia was determined during the most active period of radiation sickness. (R.V.J.)

9080

PROBLEMS IN PATHOGENESIS OF RADIATION SICKNESS. P. D. Gorizontov. Med. Radiol. 1, 9-19(1956) Jan. – Feb. (In Russian).

9081

PERIPHERO-CENTRAL RELATIONS IN RADIATION SICKNESS. M. N. Livanov. Med. Radiol. 1, 19-27(1956) Jan.-Feb. (In Russian)

9082

PROCESSES OF TISSUE RESPIRATION AND CONJUGATED OXIDIZING PHOSPHORYLATION IN EXPERIMENTAL ANIMALS DURING RADIATION SICKNESS. L. V. Mytareva (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, 35-9(1956) Jan. – Feb. (In Russian).

9083

EFFECTS OF IONIZING RADIATION OF INTESTINAL ACTIVITY. Yu. N. Uspenskiĭ (Astrakhan Med. Inst.). Med. Radiol. 1, 66-8(1956) Jan.-Feb. (In Russian)

9084

EXPERIMENTS WITH CHEMOTHERAPY IN RADIATION SICKNESS OF MONKEYS. M. A. Tumanyan, Z. V. Shevtsova (Gamaleĭ Inst. of Epidemiology and Microbiology). Med. Radiol. 2, 41-5(1956) Mar.-Apr. (In Russian)

Chemotherapy using several anitbiotics combined with vitamin therapy was applied in treatment of monkeys exposed to lethal doses of x radiation. The best results were obtained with parenteral applications of penicillin and streptomycin in combination with peroral doses of levomycin and streptomycin. The effective results obtained by chemotherapy in radiation sickness of monkeys confirm the important part played by the auto-infection and bacteremia. The experiments with monkeys exposed to lethal doses of x radiation show the organism capacity for restoration of tissues and functions when complications caused by infections are eliminated. (R.V.J.)

9085

ANTIBIOTICS AND RADIATION SICKNESS. G. Ya. Kivman (Academy of Medical Sciences of S.S.S.R.). Priroda 45, 105-7(1956) Mar. (In Russian)

Antibiotics are recommended as a protective measure against radioinduced infections originating in the intestine. Penicillin was used in the treatment of rats exposed to lethal doses of ionizing radiation. After 20 days 67% of the treated rats survived while all exposed but untreated rats perished. In β-hemolytic streptococcus infection penicillin therapy reduced the death-rate among irradiated rats from 100% to 6.4%. Streptomycin, also, proved quite effective in the treatment of mice exposed to lethal doses of x rays. After 30 days 80% of the untreated animals perished, while among the treated mice only 20% died. Streptomycin proved quite effective in the treatment of irradiated mice experimentally infected by staphilococci, intestine bacilli and other organisms. It must be mentioned that streptomycin stops diarrhea which is one of the most pronounced symptoms of radiation sickness. Aueromycin, terramycin, and

other antibiotics were tested on dogs and proved effective against mixed bacillary infection. (R.V.J.)

9086

ATTEMPTS TO PROVIDE THE RAT WITH NUTRITION DURING POST-IRRADIATION ANOREXIA. Douglas E. Smith and Ella B. Tyree (Argonne National Lab., Lemont, Ill.). Radiation Research 4, 435-48(1956) May.

RADIOGRAPHY

9087

PRACTICAL PHOTOGRAPHIC PROBLEMS IN RADIOGRAPHY WITH SPECIAL REFERENCE TO HIGH-VOLTAGE TECHNIQUE. Ove Mattsson. Acta Radiol. Suppl. 120, 1955. 206p.

Among the problems associated with the accelerated use of high kilovoltages for radiography discussed are: development of high-voltage techniques; problems of contrast and the use of intensifying screens; secondary radiation and efficient secondary diaphragms; importance of off-focus radiation and ways of reducing its undesirable effects; and the use of phantoms in technique evaluation. (F.S.)

9088

RADIOGRAPHY WITH THULIUM 170 AND XENON 133. W. V. Mayneord and J. J. D. Ireland (Royal Cancer Hospital, London). Brit. J. Radiol. 29, 277-85(1956) May.

RADIOTHERAPY

9089

A STUDY OF METHODS FOR INTERSTITIAL IMPLANTATION OF RADIOACTIVE MATERIALS. H. C. Dudley and T. G. Mitchell (U. S. Naval Hospital, St. Albans, N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1084-92(1956) June.

Results are described from in vitro and in vivo studies with various clinically promising isotopes incorporated into various types of radiation sources. Included are the dialysis of P^{32} preparations; a comparison of the distribution of P^{32} from colloidal chromic phosphate ($CrPO_4$), titanium phosphate ($Ti_3[PO_4]_4$) suspensions, and ground and fused Ti phosphate-Ge oxide (GeO_2) glass; tissue effects and distribution of Au^{198}, and P^{32} as $Ti_3(PO_4)_4$ applied in slowly soluble needles of fused GeO_2; and the tissue effects and tissue distribution of Y^{90}, applied interstitially in soluble plastic filaments. (C.H.)

9090

SOME PRACTICAL ADJUNCTIVE MEASURES IN THE HANDLING OF INTERSTITIAL COBALT 60. I. Meschan, Byron G. Brogdon, and T. H. Oddie (Univ. of Arkansas School of Medicine, Little Rock). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1093-1104(1956) June.

Various methods and items of equipment are described which present practical means of handling and storing small Co^{60} sources to assist the establishment of interstitial, intracavitary, and plaque applications. (auth)

9091

RADIOACTIVE GOLD IN THE TREATMENT OF OVARIAN CARCINOMA. H. B. Elkins and William C. Keettel (State Univ. of Iowa, Iowa City). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1117-23(1956) June.

9092

RADIOACTIVE COLLOIDAL GOLD IN THE CONTROL OF MALIGNANT EFFUSIONS. REPORT AND ANALYSIS OF 60 PATIENTS. John M. Dennis, Joseph B. Workman, and Robert E. Bauer (Univ. of Maryland School of Medicine, Baltimore). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1124-8(1956) June.

9093

RECORDING OF RADIOACTIVITY IN THE BLOOD, LIVER, AND PROSTATE FOLLOWING INTERSTITIAL ADMINISTRATION OF Au^{198} IN CARCINOMA OF THE PROSTATE. Wayne M. Rounds and Titus C. Evans (Univ. of Iowa, Iowa City). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1132-8(1956) June.

Body surveys of radioactivity are advisable following interstitial use of radiocolloids. There is marked variation of Au^{198} entering the blood stream during different prostatic injections. Blood samples should be drawn within a few minutes of the injection to reflect highest blood levels of radioactivity. Factors influencing mechanical entry into vascular channels at the injection site account for high initial circulating Au^{198}. Hyaluronidase and adrenalin have no significant effect upon immediate blood levels. Radioactivity over the liver one day after surgery provides a clinically useful estimate of liver dose. Estimated liver dose in patients following interstitial prostatic injection is occasionally in amounts comparable to levels which produce liver damage in experimental animals. (auth)

9094

FOUR CASES ILLUSTRATING THE USE OF I^{131} IN THE MANAGEMENT OF METASTATIC CARCINOMA OF THE THYROID. John P. Storaasli and Donald P. King (Univ. Hospitals of Cleveland and Western Reserve Univ. School of Medicine, Cleveland, Ohio). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1150-61(1956) June.

9095

SURGICAL AND RADIATION TREATMENT OF CARCINOMA OF THE BREAST. A NEW CONCEPT. Bertram V. A. Low-Beer and H. Glenn Bell (Univ. of California School of Medicine, San Francisco). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1162-8(1956) June.

9096

THE ROLE OF RADIOIODINE IN THE TREATMENT OF CARCINOMA OF THE THYROID. Gwen Hilton, E. E. Pochin, R. M. Cunningham, and K. E. Hainan (Univ. Coll., London). Brit. J. Radiol. 29, 297-310(1956) June.

9097

ON THE THERAPEUTIC USE OF RADIOACTIVE ISOTOPES. M. P. Domshaak. Med. Radiol. 2, 10-17(1956) Mar.-Apr. (In Russian)

TOXICOLOGY STUDIES

9098

EFFECTS OF ROENTGEN RAYS ON THE CATALASE ACTIVITY IN TISSUES OF RATS. G. V. Voskoboĭnikov (Central Research Inst. of Roentgen-Radiology). Med. Radiol. 1, 39-42(1956) Jan. – Feb. (In Russian).

9099

EFFECTS OF PRELIMINARY EXPOSURE OF ORGANISM TO PENETRATING RADIATION ON THEIR IMMUNITY TO BACTERIAL TOXICOSIS. P. N. Kiselev, and E. V. Karpova (Central Research Inst. of Roentgen Radiology). Med. Radiol. 2, 23-9(1956) Mar.-Apr. (In Russian)

9100

NEPHROTOXIC HAZARD FROM UNCONTROLLED EDATHAMIL CALCIUM–DISODIUM THERAPY. Harry Foreman, Camile Finnegan, and Clarence C. Lushbaugh (Los Alamos Scientific Lab., N. Mex.). J. Am. Med. Assoc. 160, 1042-6(1956) Mar. 24.

9101

MOLYBDENUM TOXICITY IN THE RAT. Mary Ann Williams and Robert Van Reen (Johns Hopkins Univ., Baltimore). Proc. Soc. Exptl. Biol. Med. 91, 638-41(1956) Apr.

TRACER APPLICATIONS

9102 HW-40289

Hanford Atomic Products Operation, Richland, Wash. THE ABSORPTION BY PLANTS OF BETA-EMITTING FISSION PRODUCTS FROM THE BRAVO SOIL. A. A. Selders, J. F. Cline, and J. H. Rediske. Dec. 20, 1955. 10p. Contract W-31-109-Eng-52. $0.15(OTS).

Barley and bean plants were grown to maturity in soil from a Pacific island which contained fallout material from a thermonuclear explosion. The leaves of bean and barley plants showed a concentration factor of 0.05 and 0.02, respectively, for the total β emitters absorbed. Leaves of both bean and barley plants had a higher concentration of fission products than did the fruit. Addition of nutrients to the soil decreased the uptake of fission products into the bean plant but had no effect on uptake into barley. With the exception of those for cesium, concentration factors for the individual elements were comparable with values previously obtained in the laboratory using local soils. The concentration factor of 4 to 8 for cesium is over 20 times higher than is obtained using local soils. All values are determined on oven dried material. (auth)

9103 UCLA-376

California. Univ., Los Angeles. Atomic Energy Project. THE TRANSPORT OF FATTY ACIDS IN THE BLOOD. James F. Mead and Dorothy L. Fillerup. Aug. 15, 1956. 26p. Contract AT-04-1-GEN-12. $4.80(ph OTS); $0.70(mf OTS).

9104 UCRL-3460

California. Univ., Berkeley. Radiation Lab. ACTIVE CATION TRANSPORT IN SUBMERGED AQUATIC PLANTS. I. EFFECT OF LIGHT UPON THE ABSORPTION AND EXCRETION OF CALCIUM BY POTAMOGETON CRISPUS (L) LEAVES. Benjamin Lowenhaupt. July 5, 1956. 14p. Contract W-7405-eng-48. $0.20(OTS).

9105

MATRIX THEORY OF QUANTITATIVE APPOSITION AUTORADIOGRAPHY. Erik Odeblad. Acta Radiol. 45, 323-39(1956) Apr.

A general theory of quantitative histologic apposition autoradiography is presented. The geometric exposure relationships between histologic section and photographic emulsion are given special attention. They are given a matrix formulation which considerably enlightens the understanding of exposure mechanisms, practical performance of quantitative autoradiography, and problems of autoradiographic resolution. (auth)

9106

DIAGNOSTIC TESTS THAT DEPEND ON RADIOISOTOPE LOCALIZATION. Marvin M. D. Williams and Donald S. Childs, Jr. (Mayo Clinic and Mayo Foundation, Rochester, Minn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1040-58(1956) June.

Diagnostic tests which depend on the localization of a radioisotope in some part, organ, or lesion of the body are discussed. Procedures are outlined and results reported to date are summarized. 113 references. (C.H.)

9107

SOME APPLICATIONS OF ISOTOPE DILUTION TECHNIQUES. Rosalyn S. Yalow and Solomon A. Berson. Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1059-67(1956) June.

Applications of isotope dilution techniques to the study of the size of body compartments and the study of the dynamic aspects of physiologic systems are described. Techniques are described for the determination of blood volume, total body water, exchangeable Na and K, total exchangeable serum albumin, and total exchangeable thyroid hormone. 42 references. (C.H.)

9108

SUBSTERNAL THYROID IDENTIFIED BY A SIMPLE RADIOIODINE (I^{131}) PROCEDURE. Irvin F. Hummon and Marion F. Magalotti (Cook County Hospital, Chicago). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1144-9(1956) June.

9109

ON THE ACTIVITY ON BETA RADIATION BY HUMAN BLOOD. A. I. Danilenko (Bogomol'ets Inst. of Physiology). Doklady Akad. Nauk S.S.S.R. 107, 683-4(1956) Apr. 11. (In Russian)

Blood radioactivity in persons not exposed to radiation through association with radioactive elements has been investigated. 75 samples of whole blood taken from donors of various ages and sexes, and suffering from various maladies were analyzed. The first series of samples showed radiation activity of 100 cm^3 of ashed blood equal to 2.4×10^{-10}c. This activity was attributed to the presence of K^{40}. The second series showed smaller values for β radiation than the first samples. In the last 50 samples β radiation activity varied from 1.45×10^{-10} c with an average of 22×10^{-10} c (error range of ±6%). The data are not sufficient for the evaluation of β radiation in relation to blood type, sex, or age of the donor but they can be used for studies of radioactive elements in the blood of persons working with radioactive elements. (R.V.J.)

9110

STUDIES OF BONE METABOLISM. I. COMPARISON OF THE METABOLISM OF STRONTIUM^{90} IN LIVING AND DEAD BONE. Robert D. Ray, Duane La Violette, Harold D. Buckley, and Roscoe S. Mosiman (Univ. of Washington School of Medicine, Seattle). J. Bone and Joint Surg. 37A, 143-55(1955) Jan.

9111

A CLINICAL APPRAISAL OF RADIOIODINE TESTS OF THYROID FUNCTION. William M. McConahey, Charles A. Owen, and F. Raymond Keating, Jr. (Mayo Clinic and Mayo Foundation, Rochester, Minn.). J. Clin. Endocrinol. and Metabolism 16, 724-34(1956) June.

Seven types of diagnostic radioiodine (I^{131}) tests were compared simultaneously in 92 patients with exophthalmic goiter, 46 with adenomatous goiter without hyperthyroidism, 19 with adenomatous goiter and hyperthyroidism, 13 with myxedema, 181 who were clinically normal with respect to the thyroid, and 38 who were initially suspected of having exophthalmic goiter but were later judged to be euthyroid. The most precise tests for the diagnosis of exophthalmic goiter were the 6-hour thyroidal-collection test, the thyroidal iodide-clearance test and the conversion ratio. The first is the simplest and the most rapidly performed, and requires the least radioactivity; hence, it is best for the requirements of a routine radioiodine test. Only two tests—6-hour and 24-hour thyroidal collections—were of value in the diagnosis of myxedema. None of the tests was decisive in determining whether a patient with a nodular goiter was or was not hyperthyroid. (auth)

9112

INFLUENCE OF CHELATES ON THE METABOLISM OF RADIOYTTRIUM (Y^{90}). II. H. C. Dudley and Joseph Greenberg (U. S. Naval Hospital, St. Albans, N. Y.). J. Lab. Clin. Med. 47, 891-7(1956) June.

9113

STUDIES ON COPPER METABOLISM. XXI. THE TRANSFER OF RADIOCOPPER BETWEEN ERYTHROCYTES AND PLASMA. J. A. Bush, J. P. Mahoney, C. J. Gubler, G. E. Cartwright, and M. M. Wintrobe (Univ. of Utah Coll. of Medicine, Salt Lake, City). J. Lab. Clin. Med. 47, 898-906(1956) June.

9114
THE EFFECT OF IONIZING RADIATION ON THE FORMATION OF ANTIBODIES. V. L. Troitskiĭ, O. V. Chakhava, and N. A. Kozlova (Gamalei Inst. of Epidemiology and Microbiology). Med. Radiol. 1, 49-58(1956) Jan.-Feb. (In Russian)

9115
IN VITRO METABOLISM OF DL-ALANINE-2-C-14 AND GLYCINE-2-C-14 BY TRICHINELIA SPIRALIS LARVAE. Lawrence V. Hankes and Richard D. Stoner (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 91, 443-6(1956).

CHEMISTRY

9116 BM-RI-5253
Bureau of Mines.
HELIUM AND ARGON AS INERT ATMOSPHERES IN PRODUCING TITANIUM. C. T. Baroch, T. B. Kaczmarek, and J. F. Lenc. Mar. 1955. 20p.

The test runs showed conclusively that high-purity A could be substituted for He in the reduction of $TiCl_4$ with Mg. This could be accomplished with no noticeable impairment in the quality of the resulting Ti sponge and with only minor alteration of the reduction techniques. The average hardness of metal produced under A was a few points higher than that produced under He. Many of the operating factors were virtually the same for both A and He: Feed time or feed rate, average amount of feed per run, Mg efficiency, and average amount of metal produced per run. The amount of $MgCl_2$ tapped from the A runs averaged slightly more than for the He runs. The most serious consequence in using A was clogging of vent and feed pipes and condensation of mixed chlorides on pot lids and surface of the reaction mass. Changes in operating procedure decreased plugging and condensation but did not eliminate them. The main alterations in technique were to maintain a lid temperature above 500°C on the pot lid, and to minimize the number of venting operations. (auth)

9117 ISC-738
Ames Lab., Ames, Iowa.
ANNOTATED BIBLIOGRAPHY OF 1,2-CYCLOHEXANEDIONEDIOXIME. Charles V. Banks, Howard B. Nicholas, and James L. Pflasterer. June 14, 1956. 32p. Contract W-7405-eng-82. $0.25(OTS).

A bibliography is presented for the preparation, reactions and uses of 1,2-cyclohexanedionedioxime. (W.L.H.)

9118 MCC-1023-TR-206
Delaware. Univ., Newark.
A KINETIC STUDY OF THE ALCOHOLYSIS OF DECABORANE (thesis). Thrygve R. Meeker. June 1956. 63p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The reaction of decaborane with several alcohols in various solvents has been studied in an effort to learn something of the nature of this complex molecule. The products of this reaction were found to be the same as those observed in studies by earlier workers for the case of the corresponding total reaction of diborane, i.e., hydrogen and alkyl borates. It was found possible to relate the observed rate constants, activation heats, and entropies of activation to the structure and certain properties of the molecules concerned, using the generally accepted absolute and statistical theories of chemical kinetics. A plausible activated complex supported by the kinetic data and the known reactions of decaborane is presented and its failings discussed. The formation of the activated complex is presented as the reaction of two dipolar molecules, but the nature of its decomposition to products was not clarified by the kinetic studies. The correlation of the rate data with certain molecular properties of the reactants was supported by semiquantitative calculations wherever possible. (auth)

9119 MCC-1023-TR-207
Johns Hopkins Univ., Baltimore.
THE KINETICS OF TWO ISOTOPIC EXCHANGE REACTIONS BETWEEN DIBORANE AND PENTABORANE(11) (thesis). Thomas Eugene Larson. June 1956. 70p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The kinetics of two gas-phase isotopic exchange reactions between diborane and dihydropentaborane were studied. One reaction was the exchange of deuterium between diborane and dihydopentaborane. The second reaction was the exchange of B^{10} between the same two compounds. It was found in the study of the first reaction that all eleven of the hydrogens in dihydropentaborane will undergo exchange. In the second reaction it was found that all five of the borons in dihydropentaborane will undergo exchange. Both reactions showed a 0.5 order dependence on the dihydropentaborane concentration and a first order dependence on the diborane concentration. A homogeneous mechanism to account for both reactions is proposed in which the rapid thermal dissociation of dihydropentaborane into two fragments is followed by the rate determining reactions of each of the fragments with diborane to reform the original molecules. (auth)

9120 NP-5959
Monsanto Chemical Co., Dayton, Ohio.
DEVELOPMENT OF HIGH TEMPERATURE BASE STOCK FOR HYDRAULIC FLUIDS AND LUBRICANTS. Progress Report [for] February 1956 through April 1956. Edward S. Blake, James W. Edwards, William C. Hammann, and Thomas E. Reichard. 11p. Project title: DEVELOPMENT OF HIGH TEMPERATURE BASE STOCK FOR HYDRAULIC FLUIDS AND LUBRICANTS. Contract AF33(616)-2623.

The thermal stability by the isoteniscope method was determined for sixteen compounds, twelve of which were aromatic ethers. Eleven new aromatic ethers were synthesized. Refinements incorporated into the isoteniscope bath gave more precise temperature measurement and control. Horizontal mounting of the isoteniscope bulb improved the technique over vertical mounting. (auth)

9121 NP-5965
Iowa State Coll., Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Progress Report for February 15, 1956 to May 15, 1956. Henry Gilman. 25p. Contract AF33(616)-3510.

Studies on the synthesis and properties of organogermanium compounds are continued in view of the marked resemblance of some of them to their organosilicon analogs. Triphenylgermyl-lithium is one of the key compounds for synthetic purposes. Some metalation studies of this compound have been carried out primarily because of their aid in interpreting the structure and properties of triphenylgermylmetallic compounds. The interesting triphenylgermyltriphenyltin was prepared in order to provide generalizations concerning the stability of both simple and mixed organometallic compounds having Group IV-B elements. The promising studies reported earlier with monomeric cyclic organosilicon compounds having silicon as a hetero element are extended. In order to incorporate into such types the special properties which appear to be imparted by groups like n-dodecyl and meta-biphenylyl, three have been synthesized 5-n-dodecyl-phenyl- and 5-

n-dodecyl-5-(3-biphenylyl)-dibenzosiloles. A type of compound of synthetic interest is R_3SiCH_2M, where the R groups may be like or unlike. From diphenylmethylsilylmethyllithium we have prepared (diphenylmethylsilylmethyl)-triphenylsilane. (auth)

9122 NP-6064

Mine Safety Appliances Co., Callery, Penna.

MIXING HOT DIPHENYL AND WATER. Memo Report 106. W. Milich, E. A. Schultz, and E. C. King. Feb. 17, 1956. 5p. Contract NObs-65426.

Two tests simulating a steam generator failure were made to determine the extent of the hazard resulting from mixing hot diphenyl and water. In one test diphenyl at 800°F, 500 psig was forced into water at 200°F, 300 psig. In the second test, water at 200°F, 500 psig was forced into diphenyl at 800°F, 300 psig. The pressures in both tanks equalized at 450 to 470 psig immediately following the rupturing of the disk which separated the hot diphenyl and water, with only slight variations in the temperatures in the two tanks. In the pipe connecting the two vessels the diphenyl cooled 75 to 100°F and the water temperature rose about 50°F. No reaction was evident as a result of mixing the two fluids. (auth)

9123 UCRL-3415

California. Univ., Berkeley. Radiation.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] MARCH, APRIL, MAY 1956. June 5, 1956. 70p. Contract W-7405-eng-48. $0.45(OTS).

Bioorganic Chemistry: Studies were continued on the biosynthesis of morphine, algae metabolism, inhibition of brain cholinesterase level, nucleic acid metabolism, respiratory metabolism of glucose, tracer diffusion in H_2O, radiolysis of porphyrins, and radiation stability of choline cyanides. The preparation of $HC^{14}N$, sodium decanoate-1-C^{14}, thioctic-S_2^{35} acid, and C^{14}-labeled amino acids is described. Nuclear Chemistry. Progress is reported on the development of a windowless proportional counter. The mass assignment and decay properties of Re^{181}, Er^{172}, and Tm^{172} were reported. The reactions of LaF_3-CeF_3 mixed crystals with F_2, spallation of Th^{232} with 20 to 50-Mev α-particles, spallation of U^{235} with 10 to 25-Mev deuterons, radioactivity of neutron-deficient Sb isotopes, and the crystal structure of Am were investigated. Notes on Chemical Engineering and General Chemistry research programs are included. (For preceding period see UCRL-3351.) (C.W.H.)

9124 AERE-Lib/Trans-611

THE ELECTRICAL CONDUCTIVITY OF THE SYSTEM: ARSENIC TRIBROMIDE–ETHYL ETHER. M. Ussanowitsch. Translated by R. J. Richardson from Z. physik. Chem. 124, 427-35(1926). 8p.

The specific conductivity of the $AsBr_3-Et_2O$ system was measured for the entire range of $AsBr_3$ concentrations. The conductivity rises to a maximum value of $k = 4 \times 10^{-4}$ at a concentration ~95 wt.% $AsBr_3$ and then falls quickly to the true conductivity of pure $AsBr_3$ ($k = 1.6 \times 10^{-6}$). (auth)

9125 IGRL-T/C-14

NIOBIUM TETRACHLORIDE AND ITS DISSOCIATION INTO TRICHLORIDE AND PENTACHLORIDE. (Das Niobtetrachlorid und sein Zerfall in Trichlorid und Pentachlorid.) Harald Schäfer, Camill Göser, and Lisel Bayer. Translated by J. Standring from Z. anorg. u. allgem. Chem. 265, 258-72(1951). 14p.

The hitherto unknown $NbCl_4$ can be prepared by suitable reduction of $NbCl_5$ or by chlorination of NbO_2. Some properties of $NbCl_4$ are described. The decomposition of the tetrachloride according to the equation $2NbCl_4(solid) = NbCl_3(solid) + NbCl_5(gas)$ is investigated. (auth)

9126 RAE-Trans-526

ELECTROLYTIC DISSOCIATION IN FUSED SALTS. (K Voprosu ob elektroliticheskoi dissotsiatsii rasplavlennykh solei). B. F. Markov and Yu. K. Delimarskii. Translated by R. C. Murray from Ukrain. Chem. J. 19, 255-63(1953). 10p. (AD-72451).

The degrees of dissociation of $BeCl_2$, $MgCl_2$, $CaCl_2$, $SrCl_2$, and $BaCl_2$ have been calculated from their electrical conductivity in the fused state at the m.p. Many physical properties of these fused salts such as the temperature coefficient of conductivity, the solubility of the metal in its own fused salts and transport numbers, accord with the concept of incomplete dissociation of the salts, particularly incomplete dissociation of the cation MeX^+. (auth)

9127

ZIRCONIA REACTIONS IN BINARY OXIDE SYSTEMS. Robert S. Roth (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc. 39, 196(1956) May.

9128

SOME GRAPHICAL METHODS FOR DETERMINING EQUILIBRIUM CONSTANTS. II. ON "CURVE-FITTING" METHODS FOR TWO-VARIABLE DATA. Lars Gunnar Sillen (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, 186-202(1956).

A survey is given of graphical methods for determining a number of unknown constants (parameters) $p_1, p_2 \ldots$ from a set of data $y(x)$ when the function $y(x, p_1, p_2 \ldots)$ is known. If x, y, and p_1 may be so chosen that one or two parameters can be connected with the variables to form "normalized variables" $X = x + p_1$, $Y = y + p_2$, the parameters may be found by fitting normalized curves. Such "curvefitting" is preferable to numerical or "elimination" methods. For instance, with three parameters, $y(x)$ may be fitted to a family of curves $Y(X, p_3)$; p_1 and p_2 are obtained from the shifts of the coordinate axes, and p_3 from the shape of the curve. –A linear plot is a special case of curve-fitting; linear plots, however, have limitations which often make curved plots preferable. Some examples are given from the determination of one or two complexity constants, and the determination of coefficients in simple polynomials. If there are more than 2–3 parameters, "sweeping" and successive approximation may be used; the first procedure should not be used without the second. The use of smoothed curves, instead of the experimental points, requires great caution. (auth)

9129

SOME GRAPHICAL METHODS OF DETERMINING EQUILIBRIUM CONSTANTS. III. A PROJECTION STRIP METHOD FOR TWO-PARAMETER SYSTEMS. F. J. C. Rossotti, Hazel Rossotti, and Lars Gunnar Sillen (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 10, 203-14(1956).

Experimental data may often be represented by a single curve $y(x)$. It is sometimes possible to describe this function, either rigorously or approximately, in terms of only two parameters, p_1 and p_2, such that the value of p_2 determines the shape of the curve $y(x)$, while the value of p_1 fixes its position on the x axis. Values of p_1 and p_2 may always be obtained by comparing the shape and position of the experimental $y(x)$ curve with theoretical $y(X)_{p_2}$ curves calculated for different values of p_2. It is, however, more convenient to determine them by fitting the data in the form of a projection strip $(x)_y$ to the set of theoretical curves $p_2(X)_y$, where the normalized function $X = x + p_1$. This device is used to calculate equilibrium constants for a number of systems containing polynuclear hydrolysis products, and its application to systems of mononuclear complexes is indicated. The set of curves $p_2(X)_y$ is also useful for the

rapid calculation of theoretical y(x) curves for systems in which the values of p_1 and p_2 are known. (auth)

9130

INVESTIGATION ON THE MOLECULAR STRUCTURES OF TITANIUM TETRACHLORIDE AND ZIRCONIUM TETRACHLORIDE BY GAS ELECTRON DIFFRACTION. Masao Kimura, Katsumi Kimura, Michiro Aoki, and Shuzo Shibata. Bull. Chem. Soc. Japan 29, 95-100(1956) Jan.

The molecular structures of $TiCl_4$ and $ZrCl_4$ were determined by electron diffraction as follows: Ti−Cl = 2.185 ± 0.01 A in $TiCl_4$ and Zr−Cl = 2.32 ± 0.01 A in $ZrCl_4$, and both molecules have the tetrahedral form. At the same time a in exp $(-aq^2)$, the term relating to molecular vibrations, was determined. $a_{ClCl} - a_{MCl}$ is 0.0004 to 0.0006 for $TiCl_4$ and 0.0007 to 0.0010 for $ZrCl_4$. The mean-square amplitudes of $SiCl_4$, $TiCl_4$, $GeCl_4$, $ZrCl_4$, and $SnCl_4$ were calculated using the frequencies of the normal modes of vibrations. $a_{ClCl} - a_{MCl}$ thus obtained is 0.00045 for $TiCl_4$ and 0.00094 for $ZrCl_4$. These values are in satisfactory agreement with those obtained by electron diffraction. Almost all physical properties of tetrahalides of the 4th group elements including molecular vibrations are classified into two groups, Si, Ge, Sn, and Pb tetrachlorides and Ti, Zr, Hf, and Th tetrachlorides. This will be due to the difference in bond character. (auth)

9131

SOME REACTIONS OF MONOAMMONIA−BORON TRIFLUORIDE WITH SOLUTIONS OF ALKALI METALS IN AMMONIA. W. J. McDowell and C. W. Keenan (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc. 78, 2065-9(1956) May 20.

The reactions of the alkali metals, Li, Na, K, and Cs, with liquid NH_3 solutions of $BF_3 \cdot NH_3$ have been studied. Differences in the stoichiometry of reaction for these metals have been observed: the mole ratio of metal: $BF_3 \cdot NH_3$ is 3.0 for Li, 2.5 for Na and 1.0 for both K and Cs. The products of the reaction of $BF_3 \cdot NH_3$ with K have been studied and proposals have been made as to the nature of the products of the reactions with the other metals. (auth)

9132

THE AMMONOLYSIS OF BORON TRIIODIDE IN LIQUID AMMONIA. W. J. McDowell and C. W. Keenan (Univ. of Tennessee, Knoxville). J. Am. Chem. Soc. 78, 2069(1956) May 20.

The ammonolysis of BI_3 yields NH_2I and boron imide, $B_2(NH)_3$. The imide does not react with potassium solutions in NH_3 at -33 or at 25°C. (auth)

9133

THE APPLICATION OF ISOTOPE DILUTION TECHNIQUE IN STUDIES OF REACTION RATES AND EQUILIBRIA: THE EFFECT OF DIENE STRUCTURE ON THE RATE OF THE DIELS-ALDER REACTION. Elmer J. DeWitt, Charles T. Lester, and Gus A. Ropp (Oak Ridge National Lab., Tenn. and Emory Univ., Ga.). J. Am. Chem. Soc. 78, 2101-3 (1956) May 20.

By applying a combination of techniques, it has been found possible to make for the first time a rigorous study of the effect of the electronic character of dienes on the rates of Diels-Alder reaction with maleic anhydride. Pairs of para-substituted 1-phenyl-1, 3-butadienes were permitted to compete for maleic anhydride at low temperatures. The product mixtures were analyzed by making application of isotope dilution technique, and the effects of the para substituents on the reaction rate constants were quantitatively evaluated at several temperatures. Results were correlated using the Hammett equation, and the effect of the electronic character of the series of substituents was found to be in accord with accepted ideas of the Diels-Alder reaction mechanism. (auth)

9134

KINETICS OF THERMAL DECOMPOSITION OF LIQUID NITRIC ACID. C. W. Tait, J. A. Happe, R. W. Sprague, and H. F. Cordes (U. S. Naval Ordnance Test Station, China Lake, Calif.). J. Am. Chem. Soc. 78, 2670-3(1956) June 20.

The decomposition of liquid HNO_3 at temperatures of 65 and 70°C was studied by observing the rate of evolution of O_2 from the system at atmospheric pressure. The rate data were interpreted in terms of a unimolecular decomposition of molecular N_2O_5, which results from the self-dissociation of HNO_3 into N_2O_5, NO_2^+, NO_3^-, and H_2O. Estimates of the H_2O from the dissociation obtained from this kinetic study agree with estimates obtained by other experimental techniques. Calculations based upon the parameters for the gas-phase decomposition of N_2O_5 indicate that the liquid-phase decomposition of HNO_3 can be explained if 3.2% of the total N_2O_5 from the self-dissociation is in the molecular form at 65° and 5.4% is in the molecular form at 70°C. (auth)

9135

MECHANISM OF SUBSTITUTION REACTIONS OF COMPLEX IONS. VIII. Hydrolysis of cis- and trans-CHLOROHYDROXO-BIS-(ETHYLENEDIAMINE)-COBALT(III) COMPLEXES. Ralph G. Pearson, Robert E. Meeker, and Fred Basolo (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 78, 2673-6(1956) June 20.

The rates of reaction of cis- and trans-chlorohydroxo-bis-(ethylenediamine)-cobalt(III) complexes with H_2O reported. They are considerably faster than those of the corresponding dichloro complexes. A discussion is given of the products of reaction of one mole of hydroxide ion with one mole of cis- or trans-$[Coen_2Cl_2]^+$. (auth)

9136

MECHANISM OF SUBSTITUTION REACTIONS OF COMPLEX IONS. IX. CONTRIBUTION OF INDUCTIVE EFFECTS TO THE RATES OF ACID AND BASE HYDROLYSIS OF COBALT(III) COMPLEXES. Fred Basolo, John G. Bergmann, Robert E. Meeker, and Ralph G. Pearson (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 78, 2676-8(1956) June 20.

Rates of acid and base hydrolysis have been measured for a series of $[Coen_2X\text{-}pyCl]^{+2}$ complexes. The rates of acid hydrolysis increase with increasing base strength of X-py whereas that of base hydrolysis decreases. Inductive factors contribute less than do steric factors to the rates of reaction of cobalt(III) complexes. These results are discussed in terms of the mechanisms for acid and base hydrolysis reactions. (auth)

9137

THE STRUCTURE AND CHARACTERISTICS OF THE FLUORESCENT METAL CHELATES OF o,o′-DIHYDROXY-AZO COMPOUNDS. Donald C. Freeman, Jr. and Charles E. White (Univ. of Maryland, College Park). J. Am. Chem. Soc. 78, 2678-82(1956) June 20.

A series of compounds has been synthesized and investigated in order to determine the characteristics of structure and bond type necessary for the formation of fluorescent chelates. The parent type of structure for the compounds in this series is that of o,o′-dihydroxyazobenzene. Some modifications of this basic configuration such as the bis-salicylidenediamines, salicylidene-o-aminophenols, and salicylaldehyde azines were also studied. Both non-aqueous N,N-dimethylformamide and 34% N,N-dimethylformamide in water were found to be excellent solvents for fluorescent chelation reactions. The bonds between the metal ion and the chelating agent were found to be primarily ionic in character. Transition elements do not form fluorescent chelates with this type of compound. A strong dependence of fluorescence intensity on the size of the metal ion was observed. The acidity of the medium necessary for maximum

fluorescence was found to be a critical but predictable factor. (auth)

9138

THE CATALYTIC HYDROGENATION OF PYRIMIDINE NUCLEOSIDES AND NUCLEOTIDES AND THE ISOLATION OF THEIR RIBOSE AND RESPECTIVE RIBOSE PHOSPHATES. Waldo E. Cohn and David G. Doherty (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 2863-6(1956) June 20.

The complete catalytic hydrogenation of the 4,5-double bond of pyrimidine nucelotides has been carried out under mild conditions with a rhodium catalyst. Dihydrouridylic acid, formed from either uridylic or cytidylic acid, is cleaved by dilute alkali at room temperature to give the N-ribosyl phosphate of β-ureidopropionic acid. Dilute acid at room temperature hydrolyzes this substance to ribose phosphate and β-ureidopropionic acid without appreciable isomerization of the phosphate group, thus making available the sugar phosphates of pyrimidine nucleotides. Similar reductions and degradations have been carried out on cytidine, thymidine and deoxycytidylic and thymidylic acids. From uridylic acids a and b, ribose 2- and 3-phosphates, respectively, were obtained, thus confirming the identity of the pyrimidine nucleotide isomers. (auth)

9139

TERNARY OXIDES OF TETRAVALENT MOLYBDENUM. William H. McCarroll, Roland Ward, and Lewis Katz (Univ. of Connecticut, Storrs). J. Am. Chem. Soc. 78, 2909-10 (1956) June 20.

The preparation of several ternary oxides of tetravalent Mo containing divalent Mg, Zn, Co, and Fe is described. The general formula of the oxides is A_4Mo_6O16 ($A = Mg^{2+}$, Zn^{2+}, Co^{2+}, and Fe^{2+}.). (C.W.H.)

9140

VAPORIZATION OF BORIC OXIDE AND THERMODYNAMIC DATA FOR THE GASEOUS MOLECULES B_2O_3, B_2O_2 AND BO. John R. Soulen and John L. Margrave (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 78, 2911-12(1956) June 20.

9141

INVESTIGATIONS OF THE EFFECT OF MOLECULAR STRUCTURE ON THE RATE OF IONIC AND ATOMIC ISOTOPE EXCHANGE REACTIONS. IV. CHAIN RADICAL ISOTOPE EXCHANGE OF ALKYL IODIDES WITH ELEMENTARY IODINE. M. B. Neiman, V. B. Muller, and Yu. M. Shapovalov (Moscow Inst. of Chem. Physics). Zhur. Fiz. Khim. 30, 492-9(1956) Mar. (In Russian)

The exchange reactions $RI + I_2^{131}$ in alcohol solution and $RI + I_2^{131}$ in cyclohexane solution have been studied. The investigations show that lengthening of the carbon chain, isomerization of the alkyl radical, and substitution in the CH_3I molecule of hydrogen atoms by iodine atoms diminish the rate of ionic molecular reactions and accelerate reactions with a chain radical. (tr-auth)

9142

INVESTIGATION OF BROMINE ISOTOPE EXCHANGE BETWEEN ORGANIC AND METAL BROMIDES. An. N. Nesmeyanov, V. Ya. Kabanov, Yu. P. Trusov and M. M. Privalova (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim 30, 566-76(1956) Mar. (In Russian)

Exchange of Br between NaBr, RbBr, $CaBr_2$, $BaBr_2$, $ZnBr_2$, $CdBr_2$, $SbBr_3$ and n-butyl and ethyl bromides has been studied using absolute acetone mixtures, CCl_4, dioxane, and acetonitrile as solvents. Exchange between $SbBr_3$ and n-butyl bromide was investigated in the absence of solvent and in a gaseous phase. Results showed the effect of the ionic molecular mechanism of the exchange between organic and metal bromides. The absence of exchange, observed in a number of systems is due to a slight dissociation of the bromide in the respective solvents. A new method was developed for introducing bromine into $SbBr_3$ and $AlBr_3$ which can be used in preparation of other active bromides. (tr-auth)

ANALYTICAL PROCEDURES

9143 AERE-GP/R-1994

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ISOTOPIC ANALYSIS OF BORON BY MASS SPECTROMETRY. G. H. Palmer, D. F. Dance, and K. L. Aitken. June 1956. 10p.

The suitability of BF_3 for boron isotopic analysis in gas-type mass spectrometers is reported. A preferred apparatus is described which lessens the "memory effect," though it is not eliminated. A solid source technique using borax is presented, but it retains the disadvantages generally associated with this technique. (T.R.H.)

9144 ORNL-2135

Oak Ridge National Lab., Tenn.

DETERMINATION OF BORON IN FLUORIDE SALTS. W. J. Ross, A. S. Meyer, Jr., and J. C. White. Aug. 21, 1956. 32p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

A method has been developed for the determination of trace amounts of B in fluoride salts. Samples of fluoride salts are dissolved, at room temperature, in a solution of $AlCl_3$ and HCl and then diluted with an equal volume of C_2H_5OH. A reproducible fraction of the B is extracted when the aqueous solution is equilibrated with an equal volume of ethyl ether for 5 min. The B in the ether phase is determined spectrophotometrically with carminic acid. The partition coefficient of boron, Co/Ca, is 0.59 ± 0.02 when the concentration of HCl is 4M and that of $AlCl_3$ is 2M. This coefficient is independent of temperature between 13 and 28°C. The method has been applied successfully to the determination of as little as 10μg of B is 3%. (auth)

9145 AEC-tr-2104

ANALYSIS OF THE "BIKINI ASH." (Special Collection of Papers). Translated from Japan Analyst 3, 333-68(1954). 75p.

Separate abstracts have been prepared for the six papers in this collection. (F.S.)

9146 AEC-tr-2104(p.1-6)

INTRODUCTION TO SPECIAL COLLECTION OF PAPERS. K[enjiro] Kimura. p.1-6 of ANALYSIS OF THE "BIKINI ASH." (Special Collection of Papers). Translated from Japan Analyst 3, 333-4(1955). 5p.

The incident of the Bikini ashes and the fishing boat is reported. Experiences on the boat are recorded, and fallout analyses are compared with those of Nagasaki and Hiroshima. (F.S.)

9147 AEC-tr-2104(p.7-27)

ON THE RADIOACTIVE FALL-OUT ON NO. 5 FUKURYU MARU. Kenjiro Kimura, et al. (Title and Summary in English). p.7-27 of ANALYSIS OF THE "BIKINI ASH." (Special Collection of Papers). Translated from Japan Analyst 3, 335-48(1954). 20p.

Comprehensive radiochemical analysis of the "Bikini ashes" were made to find the proper method of medical treatment for the victim fishermen on ship board. Ash consisted mostly of $Ca(OH)_2$ with an activity of 0.37 mg/g on April 23. Cations of the 3rd and 5th groups were found to have strong activity by chemical separation. Zr, Nb, and U fractions were separated by an ion-exchange method. Complete analyses were summarized. (F.S.)

9148 AEC-tr-2104(p.28-42)
RADIOCHEMICAL STUDIES ON BIKINI ASH, MARCH 1, 1954. PART I. Takanobu Shiokawa, Tokuro Ozaki, Tomihisa Kanbara, Masuo Yagi, Yoshiyasu Matsuoka, and Ayako Takasashi. (Summary in English). p.28-42 of ANALYSIS OF "BIKINI ASH." Translated from Japan Analyst 3, 349-56(1954). 15p.

The familiar quantitative methods of analysis, carrier precipitation, extraction, distillation, and ion exchange were used in these radiochemical studies of Bikini Ash. Several elements were purified to the greatest extent possible, and the nuclides identified by measuring their radiation energies and half lives. A large number of samples was used and microquantities of nuclides were detected, eliminating unreliable identifications. (F.S.)

9149 AEC-tr-2104(p.43-54)
ON THE RADIOACTIVE DUST COLLECTED FROM THE NO. 5 FUKURYU MARU. Hideo Yamatera, et al. (Summary, Title, and Author List in English). p.43-54 of ANALYSIS OF "BIKINI ASH." (Special Collection of Papers). Translated from Japan Analyst 3, 356-61(1954). 12p.

Radiochemical analyses of radioactive dust collected on board No. 5 Fukuryu Maru were made by chemical separation and measurement of β-ray energy and half life of each species. Results of radioactive nuclide and approximate % of radioactivity are summarized. (F.S.)

9150 AEC-tr-2104(p.55-60)
RADIOACTIVE SUBSTANCES FOUND IN THE SO-CALLED ATOM BLAST TUNA FISH. T. Kiba, S. Ohashi, M. Shibata, and T. Mizube. (Summary, Title and Author List in English). p.55-60 of ANALYSIS OF THE "BIKINI ASH." (Special Collection of Papers). Translated from Japan Analyst 3, 361-3(1954). 6p.

A radiochemical study was reported of the radioactive substances found in tuna fish contaminated by thermonuclear explosion fall-out. The radioactive substances were mostly nuclear fission products and paper chromatography was applied to their separation and detection. (F.S.)

9151 AEC-TR-2104(p.73-5)
A PROPOSED METHOD OF ANALYSIS OF RADIOACTIVE SUBSTANCES IN RAIN WATER. M. Honda. p.73-5 of ANALYSIS OF "BIKINI ASH." (Special Collection of Papers). Translated from Japan Analyst 3, 368(1954). 3p.

Ion exchange, using Amberlite IR-120 and Dowex 50 cation exchange resins, is proposed as a method of analysis of radioactive substances in rain water. (F.S.)

9152 TIB/T-4493
MAGNESIUM (OR ZINC) DETERMINATION IN ALUMINIUM ALLOYS BY MEANS OF HIGH VACUUM. (Die Magnesium-(BZW. Zink-) Bestimmung in Aluminiumlegierungen Mittels Hochvakuum). P. Urech and R. Sulzberger. Translated from Aluminium (Dusseldorf) 30, 163-4(1954). 6p. (AD-75032).

An apparatus for the serial determination of Mg in Al alloys is described. A two-stage rotary oil pump proved most satisfactory for the production of high vacuum. The principle of Mg determination by high-vacuum distillation is discussed. (auth)

9153
NUCLEONICS. A REVIEW OF FUNDAMENTAL DEVELOPMENTS IN ANALYSIS FROM 1953 TO DATE. W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem. 28, 736-56(1956) Apr.

The use of radioisotopes in chemical analysis is reviewed. The literature survey includes publications since 1952. 593 references. (C. W. H.)

9154
THORON-TARTARIC ACID SYSTEMS FOR SPECTROPHOTOMETRIC DETERMINATION OF THORIUM. F. S. Grimaldi and Mary H. Fletcher (U. S. Geological Survey, Washington, D. C.). Anal. Chem. 28, 812-16(1956) May.

A procedure for the spectrophotometric determination of Th is presented, using tartartic acid as a masking reagent for Zr. (C.W.H.)

9155
RECORDING NICKEL CARBONYL DETECTOR. Julian E. McCarley, Robert S. Saltzman, and Robert H. Osborn (Hercules Experiment Station, Wilmington, Del.). Anal. Chem. 28, 880-2(1956) May.

A sensitive, continuously recording nickel carbonyl detector was developed for monitoring the atmosphere of a pilot-plant area. When air, contaminated with nickel carbonyl, impinges upon a hot borosilicate glass plate, solid Ni compounds are deposited on the surface. A novel optical arrangement using polarized light incident at the Brewsterian angle for borosilicate glass measures the quantity of deposit. Concentrations in the range of 0.05 to 4 ppm. by volume can be measured. At a concentration of 1 ppm. the accuracy is ±0.2 ppm. or ±20% of the amount present. The detector is also sensitive to iron carbonyl and can presumably be used for other metallo-organic vapors and gases, such as tetraethyllead. (auth)

9156
DETERMINATION OF NICKEL IN OXIDIZED FILMS ON NICKEL METAL. B. D. Brummet and R. M. Hollweg (Thomas A. Edison, Inc., West Orange, N. J.). Anal. Chem. 28, 887-8(1956) May.

A rapid spectrophotometric method for the determination of Ni in oxidized films on Ni metal has been developed. The solvent used, 0.5% KCN, dissolves the oxidized film but not the Ni. The method is sensitive to microgram quantities of Ni. (auth)

9157
DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF FLUORIDE. Johan J. Lothe (Central Inst. for Industrial Research, Oslo, Norway). Anal. Chem. 28, 949-53(1956) June.

The differential method of analysis as applied to the indirect spectrophotometric determination of F^- with the thorium-Alizarin Red S reagent at pH 2.80 is presented. The absorbance of the sample solution is taken against one of a set of three reference standards containing 50, 100, and 200 γ of fluoride per 50 ml. The coefficient of variation of the method is less than 1% in the range 50 to 200 γ of fluoride per ml and less than 2% in the range 25 to 50 γ. The optimum composition of the color reagent and the effect of pH and foreign ions are discussed. The color reagent is stable and can be used for at least a month. (auth)

9158
FLUORESCENT X-RAY SPECTROGRAPHIC DETERMINATION OF TANTALUM IN COMMERCIAL NIOBIUM OXIDES. William J. Campbell and Howard F. Carl (Bureau of Mines, College Park, Md.). Anal. Chem. 28, 960-2(1956) June.

Recent modifications in fluorescent x-ray spectrographic instrumentation permit the resolution of the tantalum $L\alpha_1$ line from the usual interfering lines without a prohibitive loss of intensity. Tantalum $L\alpha_1$ line intensities as high as 750 counts per second can be obtained from a sample of 5% Ta_2O_5 in niobium oxide by the use of a Mo target x-ray tube, a quartz analyzing crystal, and a 4-inch Soller slit collimator. The residual Ta content of "high-purity" Nb_2O_5 was determined by use of standards prepared from Ta-free ZrO_2. Hand-mixed samples, when properly prepared, are as suitable as chemically precipitated samples. The effects of

possible impurities, such as SnO_2, FeO, TiO_2, and Na_2SO_4 on the analysis were calculated from adsorption data and determined experimentally. Only TiO_2 was found in commercial Nb_2O_5 in amounts that would result in a measurable analytical error. Fluorescent x-ray spectrography is a rapid and reliable method of analysis. It has an accuracy within ±5% of the amount present in the usual concentration range of 0.5 to 10% Ta_2O_5 and a lower limit of detection of approximately 0.03% tantalum oxide, and requires an average time per analysis of about 10 min, after preparation of standards. (auth)

9159

QUANTITATIVE SPECTROGRAPHIC DETERMINATION OF ZIRCONIUM AND NIOBIUM IN URANIUM METAL. J. A. Goleb (Argonne National Lab., Lemont, Ill.). Anal. Chem. 28, 965-7(1956) June.

A spectrographic method enables fast routine analyses of a large number of U metal samples containing about 5.5% Zr and 1.5% Nb. Excitation is by a high voltage condensed spark. The average deviation from the mean was ±2.89% for Zr and ±2.16% for Nb. Comparison of spectrographic and chemical results showed an average deviation of ±3.01% for Zr and ±3.96% for Nb. (auth)

9160

FLUOROMETRIC DETERMINATION OF THIAMINE AND RIBOFLAVIN IN MIXTURES. W. E. Ohnesorge and L. B. Rogers (Massachusetts Inst. of Tech., Cambridge). Anal. Chem. 28, 1017-21(1956) June.

A procedure has been developed for the fluorimetric determination of thiamine and riboflavin in mixtures. Standard deviations of the order of 5% for each substance were attained for concentrations from 0.5 to 40 ppm. The effects of a number of variables were evaluated. (auth)

9161

DETERMINATION OF TRACE ELEMENTS IN TITANIUM BY NEUTRON ACTIVATION ANALYSIS. W. A. Brooksbank, Jr., G. W. Leddicotte, and S. A. Reynolds (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1033-5(1956) June.

Neutron activation analysis methods were devised for the determination of trace amounts of W, Cl_2, V, Ni, Cu, Mn, and Si in Ti, Ti alloys, and Ti compounds. (auth)

9162

SIMULTANEOUS DETERMINATION OF CARBON AND HYDROGEN IN TITANIUM AND TITANIUM ALLOYS. R. B. Nunemaker and S. A. Shrader (Dow Chemical Co., Midland, Mich.). Anal. Chem. 28, 1040-2(1956) June.

The determination of C and H_2 in Ti and its alloys has been investigated using a microcombustion technique. The Ti is burned in O_2, using a Fe–Cu–Sn flux at 1200°C. The C and H_2 are converted to CO_2 and H_2O. The precision for C is within ±0.005%, and for H_2 ±0.0010%. Results agree with those obtained by the macrocombustion method for C and the vacuum extraction method for H_2. (auth)

9163

DIFFERENTIAL SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF URANIUM. C. D. Susano, Oscar Menis, and C. K. Talbott (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1072-5(1956) July.

A rapid spectrophotometric method is described for the determination of U in high concentrations with a precision equal to that of conventional volumetric or gravimetric methods. The relative absorbance of uranyl ion is measured at a wave length of 418 mμ against a highly absorbing reference standard. From the difference in absorbance, the concentration of UO_2^{2+} in excess of that in the reference standard solution is determined with a high degree of precision. A method for the determination of the optimum concentration of the reference standard is presented. The effects of trace impurities are evaluated. In the optimum range of 20 to 60 mg of U per ml, the precision is within 0.3%. (auth)

9164

ELECTROLYTIC SEPARATION AND VOLUMETRIC, ABSORPTIOMETRIC, AND COULOMETRIC ESTIMATION OF THALLIUM. William T. Foley and Roswell F. Pottie (St. Francis Xavier Univ., Antigonish, Nova Scotia). Anal. Chem. 28, 1101-4(1956) July.

Thallium may be quantitatively separated on the anode from an ammoniacal solution containing Ag^+ as a cathodic depolarizer. The mean of 41 determinations gives 116.4 as equivalent weight of the oxide, with a standard deviation of 0.35. Under certain conditions the deposit of Ag on the cathode is a precise measure of the Tl. Thallium(III) may be precisely estimated by back-titrating the solution of Tl at pH 3.5 with thorium nitrate and excess EDTA. Thallium(I) may be measured by a spectrophotometric titration at 222 mμ with standard EDTA. Thallium(III) may be estimated absorptiometrically from measurements on the chloroform extracts of thallium dibenzyldithiocarbamate at 430 mμ. Thallium(I) may be estimated with an accuracy within 0.3% by direct coulometric oxidation at the anode in an acid solution. (auth)

9165

AUTOMATIC PHOTOMETRIC TITRATIONS. Thomas L. Marple and David N. Hume (Massachusetts Inst. of Tech., Cambridge). Anal. Chem. 28, 1116-19(1956) July.

A simple logarithmic attenuator circuit which makes possible the direct recording of absorbance from the output of a Beckman Model B spectrophotometer is described. When used in conjunction with a strip-chart recording potentiometer and a constant-delivery reagent system, the apparatus is well adapted to automatic photometric titrations. The application to automatic iodometric and acidimetric procedures is described. (auth)

9166

AUTOMATIC OXIDIMETRIC MICROMETHOD FOR URANIUM. Kenneth A. Allen (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1144-7(1956) July.

A method has been developed which uses a chemical and mechanical system for the rapid and convenient determination of 10 to 100γ quantities of U. Microliter amounts of standard ceric sulfate are automatically delivered to reduce sample solutions and the volumes are recorded on the chart of a recording potentiometer. Replicate titrations of 0.5-μmole quantities of uranium show a standard (95%) deviation of ±1.2%. The relative error for smaller samples is proportionally larger, and, therefore, the method is not recommended for samples containing less than 10 γ of U. The procedure should be helpful in dealing with pure solutions of elements which are conveniently determined by oxidimetric titration, such as Fe and V. The mechanical features of the apparatus may be altered to conform to various requirements both as to expected sample sizes and redox systems. (auth)

9167

DETERMINATION OF MICRO QUANTITIES OF HYDROGEN. COMBUSTION-MANOMETRIC METHOD. Ben D. Holt (Argonne National Lab., Lemont, Ill.). Anal. Chem. 28, 1153-7(1956) July.

A combustion method has been developed for the determination of micro amounts of H_2 in U and other materials. The water produced from the combustion of the sample in an oxygen stream is collected in a capillary trap at −78°C. The trap, a U-tube which may be swiveled upward or downward by means of semiball joints, serves also as the fixed volume leg of a constant volume manometer. The vapor pressure of the entrapped water is then measured at 100°C. A low and stable blank with an average daily standard

deviation of 0.02 γ of H_2 permits the method to be sensitive to quantities of H_2 less than 0.1 γ. Simultaneous microdeterminations of both H_2 and carbon can be completed within a half hour. The sample is not subjected to low pressures. (auth)

9168

THE DETERMINATION OF ZIRCONIUM IN FLUORIDE-CONTAINING SOLUTIONS. G. W. C. Milner and G. A. Barnett (Atomic Energy Research Establishment, Harwell, Berks, England). Anal. Chim. Acta 14, 414-22(1956) May.

In the recommended procedure the zirconium is first precipitated from solution as the insoluble barium fluozirconate. After separation, the precipitate is dissolved in a mixture of nitric and boric acids and the zirconium is then precipitated as its hydroxide. This precipitate is separated, dissolved in hydrochloric acid and this solution is evaporated to fumes of perchloric acid to remove completely fluoride ions. The zirconium content is then determined volumetrically by adding a slight excess of a standard solution of ethylenediaminetetra-acetic acid and back titrating with a standard iron solution at pH 2.3 using potassium benzohydroxamate as indicator and the photometric technique for end-point detection. This method is applicable to the determination of milligram amounts of zirconium in fluoride-containing nitric or hydrochloric acid solutions provided that the concentration of these acids is below 3N. It is also suitable for the determination of zirconium in the presence of any of the following elements—uranium, titanium, niobium, tantalum, molybdenum, tungsten, lead, iron, copper, and tin. (auth)

9169

QUADRIVALENT URANIUM AS A REDUCING AGENT IN POTENTIOMETRIC TITRATIONS. II. ESTIMATION OF DICHROMATE, PERMANGANATE, BROMATE, AND TELLURATE. I. M. Issa and I. M. El Sherif (Cairo Univ., Giza, Egypt). Anal. Chim. Acta 14, 474-81(1956) May.

Quadrivalent uranium can further be used for the estimation of $K_2Cr_2O_7$, $KMnO_4$ (in acid or alkali), H_2TeO_4 and $KBrO_3$ either alone or in conjunction with Fe^{3+}, Ce^{4+} and V^{5+}. The reaction proceeds rapidly in dilute acid solutions and especially when Fe^{3+} iron is used as a catalyst. Reduction of aqueous $KMnO_4$ gives MnO_2 which then dissolves in the acid of the reagent and undergoes reduction to Mn^{2+}. In acid solutions no MnO_2 separates. In alkaline medium (1.5 to 3N NaOH) $KMnO_4$ is reduced absolutely to MnO_2. (auth)

9170

QUADRIVALENT URANIUM AS A REDUCING AGENT IN POTENTIOMETRIC TITRATIONS. I. ESTIMATION OF FERRIC AND CERIC SALTS. I. M. Issa and I. M. El Sherif (Cairo Univ., Giza, Egypt). Anal. Chim. Acta 14, 466-73 (1956) May.

Quadrivalent uranium is found to be a suitable reducing agent in potentiometric titrations, for the estimation of ferric and ceric salts. The stability of the reagent increases by raising the acidity and becomes considerable in the presence of HCl. The stability is not seriously affected by H_3PO_4 although Zn^{2+} and Co^{2+} ions enhance its oxidation. Light affects the stability of the reagent only in the presence of air. The redox potential varies with acidity, being 0.3 volt at 0.1N HCl or H_2SO_4 rising to 0.53 or 0.61 in 1 to 7N HCl or 1 to 9N H_2SO_4 and increasing thereafter to ~1 volt. (auth)

9171

ANALYTICAL CHEMISTRY OF BERYLLIUM. VI. 8-HYDROXYQUINALDINE AS A REAGENT FOR DETERMINATION OF BERYLLIUM. Kenji Motojima. Bull. Chem. Soc. Japan 29, 29-32(1956) Jan.

The methods for determining Be with 8-hydroxyquinaldine, are fairly sensitive and the procedures are simple. The precipitate formed is well-defined insoluble crystalline, easily filtered and washed, and thermally stable. The gravimetric factor is very small, 0.02770, and the volumetric factor is low, 1 ml of 0.1N potassium bromate solution corresponding to 0.1127 mg of Be, so that, a few milligrams of Be can be determined, both gravimetrically and volumetrically, with good accuracy. (auth)

9172

ANALYTICAL CHEMISTRY OF BERYLLIUM. VII. SPECTROPHOTOMETRIC DETERMINATION OF MICRO QUANTITIES OF BERYLLIUM WITH 8-HYDROXYQUINALDINE. Kenji Motojima. Bull. Chem. Soc. Japan 29, 71-5(1956) Jan.

The spectrophotometric method for determination of microquantities of Be with 8-hydroxyquinaldine was established. By this method from 2 to 30 μg of Be in about 40 ml can be determined simply and accurately. Small quantities of Al do not interfere with this method, and even in the presence of a minute amount of Fe, Be can be determined by making a correction for the amount of Fe present. Therefore complete separation of Al and Fe is not necessary. Moreover, the separation method of Be from relatively large amounts of Fe, Al, and Ti was studied. (auth)

9173

ANALYTICAL CHEMISTRY OF BERYLLIUM. VIII. FLUOROMETRIC DETERMINATION OF MICRO QUANTITIES OF BERYLLIUM WITH 8-HYDROXYQUINALDINE. Kenji Motojima. Bull. Chem. Soc. Japan 29, 75-7(1956) Jan.

The fluorimetric method for determination of micro quantities of Be with 8-hydroxyquinaldine was established. By this method from 0.3 to 3 μg of Be in about 40 ml of solution can be determined. The method of removing relatively large amounts of Fe and Al from micro quantities of Be by the extraction separation method with oxine was also studied, and satisfactory results were obtained. (auth)

9174

PAPER CHROMATROGRAPHY OF RADIOACTIVE SUBSTANCES. (RADIOCHEMICAL STUDIES ON "BIKINI ASHES" (MARCH 1, 1954), PART III). (STUDIES OF THE ANALYTICAL CHEMISTRY OF FILTER PAPER XVI). Shoichi Nakano. Bull. Chem. Soc. Japan 29, 219-24(1956) Mar.

9175

THE POLAROGRAPHY OF NIOBIUM. D. J. Ferrett and G. W. C. Milner (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 1186-92(1956) May.

The polarographic behavior of Nb in various complexing solutions has been studied with conventional polarographic equipment and with the square-wave polarograph. Previous work in sulphuric, hydrochloric, tartaric, and oxalic acid has been re-investigated. Polarographic steps for Nb have been found in a new series of complexing solutions, e.g., malic, lactic, gluconic, and citric acid. The polarography of Nb in ethylenediaminetetra-acetic acid solutions has been studied in detail. Of these complexes, that of Nb citrate is the most stable to hydrolysis and is easily prepared. The step at −0.86 V (vs. S.C.E.) from 2M-citric acid solutions of pH 1 can be used for the determination of from 0.1 to at least 250 μg of Nb per ml. This step is free from interference by manganese, nickel, chromium, iron, or tungsten, but antimony, titanium, or molybdenum interferes. (auth)

9176

TOTAL SODIUM, POTASSIUM AND CHLORIDE IN ADULT MAN. Gilbert B. Forbes and Anne M. Lewis (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Clin. Invest. 35, 596-600(1956) June.

9177

ANALYTICAL ASPECTS OF SOME ORGANIC COMPOUNDS. PART III. 1-HYDROXY-2-NAPHTHOIC ACIDS IN THE

ESTIMATION OF ZIRCONIUM. Sachindra Kumar Datta. J. Indian Chem. Soc. 33, 257-60(1956) Apr.

9178

LIQUID-LIQUID EXTRACTION PROCEDURES IN INORGANIC ANALYSIS. A REVIEW OF PRACTICAL APPLICATIONS WITH PARTICULAR REFERENCE TO METALLURGICAL ANALYSIS. T. S. West (Univ. of Birmingham, England). Metallurgia 53, 234-6(1956) May.

The development of new separation methods has made possible the continued use of classical analytical procedures in the face of increasing competition from physical methods. Liquid-liquid solvent extraction techniques for Ti, Hf, Zr, Th, Sn, Tb, and Ge are surveyed with particular reference to metallurgical analysis. See also Metallurgia 53, 188 (1955) April. (F.S.)

9179

A SPECTROGRAPHIC METHOD FOR DETERMINING THE HAFNIUM-ZIRCONIUM RATIO IN ZIRCON. C. L. Waring and H. W. Worthing. U. S. Geol. Survey Bull. 1036-F, 1956. 12p. $0.15(GPO).

9180

CONVENIENT METHOD FOR RECOGNIZING NONOPAQUE CERIUM EARTH MINERALS. K. J. Murata and Harry Bastron (U. S. Geological Survey, Washington, D. C.). Science 123, 888-9(1956) May 18.

Refer also to abstracts 9240 and 9446.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

9181 AERE-M/R-1854

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

X-RAY DIFFRACTION STUDIES OF 'ACTIVE' MAGNESIUM OXIDE. D. K. Thomas and T. W. Baker. Jan. 20, 1956. 10p.

Precise determinations of line broadening in the x-ray diffraction patterns of MgO have permitted correlation of the variation in "activity" of different preparations with the mean crystallite sizes. Results are in agreement with those expected theoretically. (auth)

9182

THE CRYSTAL STRUCTURE OF THE DEUTERIDES OF YTTERBIUM AND EUROPIUM. William L. Korst and James C. Warf (Univ. of Southern California, Los Angeles). Acta Cryst. 9, 452-4(1956) May.

Ytterbium and europium have been found to form deuterides which are isostructural with the hydrides of the alkaline earth metals. (auth)

9183

JOINT NOTE ON THE β-URANIUM STRUCTURE. Charles W. Tucker, Jr. and Peter Senio (Knolls Atomic Power Lab., Schenectady, N. Y.) and J. Thewlis (Atomic Energy Research Establishment, Harwell, Berks, England) and H. Steeple (Coll. of Tech., Manchester, England). Acta Cryst. 9, 472-4(1956) May.

The single-crystal and powder x-ray-diffraction methods were used for the determination of the crystal structure of β-uranium. Results are compared. (C.W.H.)

9184

THE CRYSTAL STRUCTURE OF $KBrF_4$. Stanley Siegel (Argonne National Lab., Lemont, Ill.). Acta Cryst. 9, 493-5(1956) June.

$KBrF_4$ is tetragonal, with a = 6.162 ± 0.002, c = 11.081 ± 0.002 kX. The observed density leads to 4 molecules in the cell, with a calculated density $\rho = 3.06$ g/cm^3. The space group is D_{4h}^{18}-I4/mcm. The fluorine atoms are distributed in tetrahedral configurations about each bromine atom, with Br-F = 1.81 A. The F-F distances within the BrF_4 group are 2.81 and 3.03 A. Each potassium is bonded to 8 fluorines, with K-8F = 2.84 A. (auth)

9185

CRYSTALLOGRAPHIC DATA: POTASSIUM COPPER DICYANIDE, $KCu(CN)_2$. Eugene Staritzky and Donald I. Walker (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 419(1956) Mar. POTASSIUM SILVER DICYANIDE, $KAg(CN)_2$. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 419-20(1956) Mar. POTASSIUM GOLD DICYANIDE, $KAu(CN)_2$. Eugene Staritzky and Finley H. Ellinger (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 420-1(1956) Mar. POTASSIUM DICOPPER TRICYANIDE MONOHYDRATE, $KCu_2(CN)_3.H_2O$. Donald I. Walker and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 421-2(1956) Mar. TRIPOTASSIUM COPPER TETRACYANIDE, $K_3Cu(CN)_4$. Eugene Staritzky and Finley H. Ellinger (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 422(1956) Mar. TRIPOTASSIUM SILVER TETRACYANIDE, $K_3Ag(CN)_4$. Eugene Staritzky and Finley H. Ellinger (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 423(1956) Mar. NEODYMIUM SESQUIOXIDE, Nd_2O_3, Form A. R. M. Douglass (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 551-2 (1956) Apr. SAMARIUM SESQUIOXIDE, Sm_2O_3, Form B. R. M. Douglass and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 552(1956) Apr. INDIUM SESQUIOXIDE, In_2O_3. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 553(1956) Apr. ZIRCONIUM DISULFATE TETRAHYDRATE, $Zr(SO_4)_2.4H_2O$. Eugene Staritzky and Joseph Singer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 553-4 (1956) Apr. AMMONIUM NEODYMIUM DISULFATE TETRAHYDRATE, $NH_4Nd(SO_4)_2.4H_2O$. Eugene Staritzky and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 554-5(1956) Apr. DINEODYMIUM TRISULFATE PENTAHYDRATE, $Nd_2(SO_4)_3.5H_2O$. Eugene Staritzky and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 555(1956) Apr. CERIUM TETRAIODATE, $Ce(IO_3)_4$. Eugene Staritzky and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 913(1956) May. LEAD DIIODATE, $Pb(IO_3)_2$. Eugene Staritzky and Donald I. Walker (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 914(1956) May. COBALT TRIFLUORIDE, CoF_3. Eugene Staritzky and R. M. Douglass (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 914-15(1956) May. DIBERYLLIUM CARBIDE, Be_2C. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 915(1956) May. BERYLLIUM SULFIDE, BeS. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 914(1956) May. DIPOTASSIUM PLATINUM TETRACHLORIDE, K_2PtCl_4. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 915-16(1956) May. LITHIUM HYDRIDE, LiH, AND LITHIUM DEUTERIDE; LiD. Eugene Staritzky and Donald I. Walker (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1055(1956) June. URANIUM TRICHLORIDE, UCl_3. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1055-6(1956) June. URANIUM TETRACHLORIDE, UCl_4. Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1056(1956) June. URANIUM TRIFLUORIDE, UF_3. Eugene Staritzky and R. M. Douglass (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1056-7(1956) June.

9186

CRYSTALLOGRAPHIC DATA: URANIUM MONOCHLOROTRIFLUORIDE, $UClF_3$. Eugene Staritzky and R. M. Douglass (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1210(1956) July. URANYL CARBONATE, UO_2CO_3. Eugene Staritzky and Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1211(1956) July. URANIUM(IV)

PYROPHOSPHATE, UP_2O_7, ORTHORHOMBIC FORM. R. M. Douglass and Eugene Staritzky (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 28, 1211-12(1956) July.

DEUTERIUM AND DEUTERIUM COMPOUNDS

9187

ON THE INFRARED ABSORPTION OF WATER AND HEAVY WATER IN CONDENSED STATES. Paul A. Giguere and K. B. Harvey (Laval Univ., Quebec, Canada). Can. J. Chem. 34, 798-808(1956) June.

The infrared spectra (from 2 to 30 μ) of thin films of H_2O and D_2O were measured at various temperatures between 20 and −180°C. A strong absorption band due to the librational mode of the water molecule has its maximum around 710 $cm.^{-1}$ in the liquid. In ice it is shifted to 800 cm^{-1} at −15°C. and 850 cm^{-1} at −170°C. The corresponding D_2O bands show the normal isotope shift. Thin films of water pressed between silver chloride plates could not be crystallized even at liquid air temperature as confirmed by their spectra, which were almost identical with those of the liquid. (auth)

9188

ROTATION-VIBRATION SPECTRA OF DEUTERATED WATER VAPOR. W. S. Benedict (Johns Hopkins Univ., Baltimore) and N. Gailar and Earle K. Plyler (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 24, 1139-65(1956) June.

Spectra of heavy water have been obtained under high resolution between 1.25 to 4.1μ (2400 to 8000 cm^{-1}). Approximately 4500 lines have been measured, and the majority of them analyzed into ten bands of D_2O and nine bands of HDO. The analysis is described in some detail, spectra of all bands are shown and a partial table of lines and a complete table of energy levels are presented. The vibration-rotation constants are derived and compared with those of H_2O. (auth)

Refer also to abstract 9182.

FLUORINE AND FLUORINE COMPOUNDS

9189

IONIZATION AND DISSOCIATION OF NITROGEN TRIFLUORIDE BY ELECTRON IMPACT. Robert M. Reese and Vernon H. Dibeler (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 24, 1175-7(1956) June.

A mass spectrometric study of NF_3 provides data on the relative abundances and appearance potentials of the NF_3^+, NF_2^+, NF^+, N^+, F^+, F^-, and F_2^- ions. The heat of formation of the NF_3 molecule is used to determine the probable processes of formation of the N^+ and F^+ ions and to calculate the ionization potentials of the NF and NF_2 radicals. (auth)

9190

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. XII. m-FLUOROCHLOROBENZENE. F. W. Harris, N. A. Narasimham, and J. Rud Nielsen (Univ. of Oklahoma, Norman). J. Chem. Phys. 24, 1232-5(1956) June.

The infrared absorption spectra of gaseous and liquid m-fluorochlorobenzene have been obtained in the region 2 to 38μ with NaCl and CsBr prisms. The Raman spectrum of the liquid has been photographed with a 3-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. A complete assignment of the fundamental vibrational frequencies is given, and the spectra are interpreted in detail. (auth)

9191

DISSOCIATION ENERGY OF FLUORINE. Kurt L. Wray and Donald F. Hornig (Brown Univ., Providence, R. I.). J. Chem. Phys. 24, 1271-2(1956) June.

The dissociation energy of F_2 in gas mixtures containing He, F_2, and A is estimated to be ~31 kcal/mol for the composition range 2.5 to 9.7% F_2. (C.W.H.)

9192

COMPLEX FLUORIDES. PART V. COMPLEXES FORMED BY MOLYBDENUM HEXAFLUORIDE, TUNGSTEN HEXAFLUORIDE, AND RHODIUM TETRAFLUORIDE. B. Cox, D. W. A. Sharp, and A. G. Sharpe (University Chemical Lab., Cambridge, England). J. Chem. Soc., 1242-4(1956) May.

The hexafluorides of molybdenum and tungsten combine with potassium, rubidium, and cesium fluorides to form complexes of general formulae M_2MoF_8 and M_2WF_8. The complex fluoride which is obtained by interaction of bromine trifluoride and sodium hexachlororhodate(III) is sodium hexafluororhodate(IV), Na_2RhF_6. (auth)

9193

DENSITY, VAPOR PRESSURE AND HEAT OF VAPORIZATION OF 2,2,3-TRICHLOROHEPTAFLUOROBUTANE. R. H. Capps and W. Morrison Jackson (Electro Metallurgical Co., Niagara Falls, N. Y. and Union Carbide Nuclear Co., Oak Ridge, Tenn.). J. Phys. Chem. 60, 811-12(1956) June.

Refer also to abstract 9157.

GRAPHITE

9194 WADC-TR-54-491(Pt. 2)

Stanford Research Inst., Menlo Park, Calif.

INVESTIGATION OF CARBON (GRAPHITE) BASE MATERIALS SUITABLE FOR ROCKET AND RAM-JET APPLICATIONS. [Period covered] April 1954—April 1955. William D. Smiley. Nov. 1955. 46p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33 (616)-2023.

The details of the laboratory preparation and laboratory performance of carbon base materials developed for rocket nozzle applications are reported. Rocket nozzles were fabricated from these materials for evaluation at the WADC and Bell Aircraft Corporation rocket test stands. The most promising nozzle material developed is zirconium-impregnated graphite. The formation of an adherent refractory skin of zirconium dioxide on the surface during operating service is responsible for the dimensional stability of this type of nozzle. (auth)

9195

PROPERTIES OF GRAPHITE COMPOUNDS. G. R. Hennig (Argonne National Lab., Lemont, Ill.). pp.103-12 in Proceedings of the Conferences on Carbon, University of Buffalo, New York, 1956.

An attempt has been made to classify and interpret various reversible chemical reactions of graphite. In many chemical reactions, graphite retains those properties which depend upon the covalent carbon layers. These reactions can often be reversed by suitable changes in conditions. Three principal types of such reactions are known: introduction of interstitial reactants into the graphite lattice, introduction of substitutional reactants into the lattice, and reaction with graphite surface atoms. Compounds of graphite with boron are probably substitutional compounds. Graphite containing lattice vacancies can also be thought of as a substitutional compound. Most reactions of graphite lead to the formation of interstitial compounds. These are apparently always either considerably better electrical conductors than graphite in which case they are acceptor or donor compounds, or they are insulators. The insulating types of compounds owe their stability to the formation of covalent bonds. The other interstitial compounds are formed because the transfer of electrons between impurity and graphite provides the

necessary energy. This dependence of stability on ionization and the resultant peculiar periodicity of the compounds has been investigated. Surface compounds of graphite have been studied by paramagnetic resonance techniques and by the controlled oxidation of single crystals. Some of the surface atoms of graphite can be stabilized under suitable conditions, the stabilization results in unusual geometric figures at the burned surfaces. (auth)

Refer also to abstract 9674.

LABORATORIES AND EQUIPMENT

9196 DP-162

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

APPARATUS FOR REMOTE CHEMICAL OPERATIONS. Mark D. Snyder. June 1956. 27p. Contract AT(07-2)-1. $0.25(OTS).

Laboratory apparatus for performing remote chemical operations was developed around interchangeable glass components and master slave operation. (auth)

9197

LABORATORY FOR REMOTE ANALYSIS OF HIGHLY RADIOACTIVE SAMPLES. F. W. Dykes, R. D. Fletcher, E. H. Turk, J. E. Rein, and R. C. Shank (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem. 28, 1084-91(1956) July.

The function of the Idaho Chemical Processing Plant is to recover enriched uranium from expended fuel elements from various types of reactors. The Remote Analytical Facility provides facilities for chemical research on extremely radioactive materials and for around-the-clock analytical service for operation of the processing plant. The general building layout and some typical remote analytical apparatus are described. (auth)

9198

MELTING POINT DETERMINATION OF HAFNIUM, ZIRCONIUM, AND TITANIUM. D. K. Deardorff and Earl T. Hayes (U. S. Bureau of Mines, Albany, Oreg.). J. Metals 8, 509-11 (1956) May.

An improved technique is described for the accurate determination of melting points of metals in the temperature range 1500 to 2500°C. The improvements consist of gradient heating and refinements in cavity preparation to obtain true black-body conditions. The melting point of Hf, as determined by this method, is set at 2222 ± 30°C. This is over 200°C higher than one of the values reported earlier. Discrepancies in the previously reported values for the melting point of Hf are explained. The melting points of Zr and Ti are found to be 1855 ± 15°C and 1668 ± 10°C, respectively. Reproducibility of results was ±3°C. (auth)

MOLECULAR STRUCTURE

9199 NP-5951

Western Reserve Univ., Cleveland. Inorganic Research Lab.

INORGANIC MACROMOLECULES: SILICON–OXYGEN–TITANIUM SYSTEMS. Technical Report No. 1. Charles A. Brown and Vernon A. Zeitler. Oct. 1, 1955. 40p. Project NR 052-355. Contract Nonr-1439(02).

Studies were initiated on compounds containing Si–O–Ti bonds. The preparation, properties, and infrared spectra of several tetra-substituted Ti and Si compounds are described. Infrared absorption peaks at 926 cm^{-1} in solid compounds and 919 cm^{-1} in solutions were tentatively assigned to the Si–O–Ti bond. A modified apparatus for the heating of an ebulliometer by means of radio frequency induction is described. (C.W.H.)

RADIATION CHEMISTRY

9200

INSTRUMENTAL DETERMINATION OF RATES OF PEROXIDE DECOMPOSITION IN HOMOGENEOUS REACTOR FUELS. G. M. Watson, M. D. Silverman, and H. F. McDuffie (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 1107-8(1956) July.

A conductance method has been developed for following the decomposition of peroxide in aqueous UO_2SO_4 solutions at very fast rates which preclude successful use of standard chemical methods. The conductance method, which agrees with the chemical method to within 5%, has been used to investigate catalytic effects from possible corrosion and fission product species present in homogeneous reactor solutions. (auth)

9201

COMPARISON OF THE ORGANIC PRODUCTS FROM THE Br^{80m} (4.4 hr) $\xrightarrow{I.T.}$ Br^{80} (18 min) PROCESS IN THE PROPYL BROMIDES WITH THOSE FROM THE $Br^{79}(n,\gamma)Br^{80}$ PROCESS. Gerrit Levey and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 78, 2351-3(1956) June 5.

It has been shown previously that activation of Br_2 by the (n,γ) and by the isomeric transition processes in solutions of Br_2 in CCl_4 yields the same distribution of organic products. This research shows a similar result for five products (CH_2Br_2, C_2H_5Br, n-C_3H_7Br, i-C_3H_7Br and 1,2-$C_3H_6Br_2$) from the (n,γ) and I. T. activation of Br_2 in n-C_3H_7Br and i-C_3H_7Br, thus lending support to the conclusion that the product determining steps are the same for the two methods of activation. (auth)

9202

STUDIES OF THE RECOIL TRITIUM LABELING REACTION. I. GLUCOSE AND GALACTOSE. F. S. Rowland, C. Nigel Turton, and Richard Wolfgang (Princeton Univ., N. J. and Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 78, 2354-8(1956) June 5.

The reactions of $Li^6(n,\alpha)$ recoil tritons have been investigated in crystalline glucose and galactose. Approximately 2% of the tritium stopped in the organic phase is found in the non-labile C–H positions in otherwise unchanged hexose molecules. The tritium shows widely varying specific activities in the various non-labile positions. Possible reaction mechanisms for the incorporation of tritium into hexoses are discussed. (auth)

9203

CHEMICAL ACTION OF IONIZING RADIATIONS IN SOLUTION. PART XV. EFFECT OF MOLECULAR OXYGEN IN THE IRRADIATION OF AQUEOUS BENZENE SOLUTIONS WITH X-RAYS. M. Daniels, G. Scholes, and J. Weiss (Univ. of Durham, Newcastle upon Tyne, England). J. Chem. Soc., 832-4(1956) Apr.

The chemical effects of x-rays (200 kv) on aqueous benzene have been investigated further with particular reference to the nature of the products (in addition to phenol) formed in the presence of dissolved O_2. Under these conditions, small amounts of an aldehyde, probably mucondialdehyde, are produced; it is suggested that this is produced via the intermediary formation of organic peroxy-radicals. (auth)

9204

EFFECT OF SOLUTE CONCENTRATION IN THE IRRADIATION OF AQUEOUS SOLUTIONS BY IONIZING RADIATIONS. G. R. A. Johnson, G. Scholes, and J. Weiss (King's Coll., Newcastle upon Tyne, England). Nature 177, 883-4 (1956) May 12.

9205

EQUIPMENT FOR ELECTRON IRRADIATIONS. Richard M.

Lemmon and Duane F. Mosier (Univ. of California, Berkeley). Radiation Research 4, 373-7(1956) May.

Equipment is described which was used for the electron irradiation of 50- to 100-mg samples of organic compounds contained in glass tubes under high vacuum. The entire electron beam was allowed to pass through the sample and to impinge on an electron collector mounted behind the sample holder. The sample holder and the electron collector were mounted in a high vacuum so as to avoid air scattering of the electron beam and air ionization. The experimental set-up is described which permits fairly accurate estimates of the energies imported by the electron beam to the samples. (C.H.)

9206

CHEMICAL YIELDS OF IONIZING PARTICLES IN AQUEOUS SOLUTIONS: EFFECT OF ENERGY OF PROTONS AND DEUTERONS. Edwin J. Hart, Warren J. Ramler, and Sol R. Rocklin (Argonne National Lab., Lemont, Ill.). Radiation Research 4, 378-93(1956) May.

Ferric ion yields, $G(Fe^{+++})$ and $G(Fe^{+++} - Cu^{++})$, are reported for protons in the energy range from 0.3 to 2.0 Mev and for deuterons in the range from 3.5 to 21.2 Mev. The significance of these yields in terms of free radical and molecular product distribution along the track of ionizing particles in aqueous solutions is also discussed. (auth)

9207

THE ACTION OF α-PARTICLES ON SOLUTIONS CONTAINING FERROUS AND CUPRIC IONS. D. M. Donaldson and N. Miller (Edinburgh Univ.). Trans. Faraday Soc. 52, 652-9(1956) May.

RADIATION EFFECTS

9208

EFFECT OF γ RADIATION ON THE EXCHANGE BETWEEN TRIVALENT AND HEXAVALENT CHROMIUM IONS IN AQUEOUS ACID SOLUTIONS. Marc Lefort and Michel Lederer. Compt. rend. 242, 2458-61(1956) May 14. (In French)

The use of Cr^{51} has allowed proof of a γ induced exchange between the III and VI valences of Cr. Proof is thus given of an oxidation reaction of the Cr^{III} ions by the OH radicals arising from the radiolysis of H_2O. This reaction only partially offsets with the reduction of the Cr^{VI} ions observed as a total phenomenon. (tr-auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

9209

SEPARATION OF THE LANTHANONS AT AMALGAM CATHODES. II. THE SEPARATION OF SAMARIUM FROM GADOLINIUM AND PURIFICATION OF EUROPIUM AT A LITHIUM AMALGAM CATHODE. E. I. Onstott (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 2070-6(1956) May 20.

Samarium is efficiently separated from Gd by electrolysis of the citrate complexes at a Li amalgam cathode. Separation factors varying between 340 and 6220 were calculated. The separation can also be done in acid solution at a pH of about 5 with citrate absent. Data were obtained which show how the electrolysis is dependent on the cathode potential and the pH of the electrolyte. Lithium amalgam is shown to be superior to Na amalgam for the separation. It is shown that Eu is electrolyzed into a Li amalgam cathode at a rate approximately equal to that predicted when the parameters of electrolyte volume cathode area, and temperature are changed. Europium of better than 99.9% purity was isolated from Eu–Sm mixtures by proper control of the cathode potential. (auth)

9210

SOME PROPERTIES OF HEXABORIDES OF ALKALI AND RARE EARTH METALS. G. V. Samsonov and A. E. Grodshteĭn (Kalinin Inst. of Non-ferros metals and Gold). Zhur. Fiz. Khim. 30, 379-82(1956) Feb. (In Russian)

Specific weights, microhardness indices, coefficients of thermal expansion, specific resistances and thermionic emission of hexaborides of Ce, La, Ba, and Ca have been evaluated and the periods of their crystal lattices have been determined. The relation between the above properties and the characteristics of hexaboride electronic structures are discussed. (tr-auth)

Refer also to abstract 9522.

SEPARATION PROCEDURES

9211 CEA-390

France. Commissariat à L'Énergie Atomique, Paris.

UTILISATION, A CHAUD, D'UNE COLONNE DE RESINE RECHANGEUSE D'IONS APPLICATION A LA SEPARATION $^{91}Y - ^{147}Pm$. (Use, in a Heated State, of an Ion Exchange Resin Column. Application to the Separation $Y^{91} - Pm^{147}$). G. Bloch and P. Cohen. Feb. 14, 1955. 6p.

9212 ORO-155

North Carolina State Coll., Raleigh.

THE PERFORMANCE OF CONTACTORS FOR LIQUID-LIQUID EXTRACTION. Progress Report No. 2 Covering Period March 15, 1952 to July 1, 1952. D. S. Arnold, C. A. Plank, and F[rederick] P[hilips] Pike. July 1, 1952. 55p. Contract AT(40-1)-1320. $10.80(ph OTS); $3.90(mf OTS).

Data have been presented which indicate that for single phase flow through a given perforated plate the orifice coefficients may be correlated by the Reynolds number for flow through the individual perforations. (For preceding period see ORO-112.) (W.L.H.)

9213 ORO-156

North Carolina State Coll., Raleigh.

THE SOLUBILITY OF BENZENE IN WATER. Progress Report No. 5 [on] THE PERFORMANCE OF CONTACTORS FOR LIQUID-LIQUID EXTRACTION. Frederick Philips Pike. Mar. 20, 1954. 55p. Contract AT(40-1)-1320. $9.30(ph OTS); $3.60(mf OTS).

A technique for preparing large volumes of standard aqueous solutions of slightly soluble liquids has been devised. A technique of sampling, diluting and transferring of homogeneous benzene-in-water solutions has been developed. It was confirmed that even dilute solutions of benzene in water have two strong absorption peaks, at 248.5 mμ and about 254 mμ respectively. A calibration curve has been obtained between weight % benzene in solution and absorbance of the 254 mμ wavelength, employing a Beckmann model DU spectrophotometer. Solubility data have been obtained for benzene in water at atmospheric pressure over the range from 0.4 to 69.0°C. (For preceding period see ORO-141.) (W.L.H.)

9214 ORO-157

North Carolina State Coll., Raleigh.

THE SOLUBILITY OF WATER IN BENZENE. Progress Report No. 6 [on] THE PERFORMANCE OF CONTACTORS FOR LIQUID-LIQUID EXTRACTION. Frederick Philips Pike. Apr. 21, 1954. 72p. Contract AT(40-1)-1320. $12.30(ph OTS); $4.50(mf OTS).

The solubility of water in benzene has been measured from 8.8 to 65.0°C. Solubility values derived from fitted equation at even temperatures are presented. (For preceding period see ORO-156.) (W.L.H.)

9215

STUDIES ON THE EXTRACTION OF METAL COMPLEXES.

XXIII. ON THE COMPLEX FORMATION OF THORIUM WITH SALICYLIC ACID, METHOXYBENZOIC ACID, AND CINNAMIC ACID. Brita Hök-Bernström (Research Inst. of National Defence, Sundbyberg, Sweden and Univ. of Stockholm, Sweden). Acta Chem. Scand. 10, 174-85(1956).

The extraction of Th with salicylic acid H_2A, methoxybenzoic acid HA, and cinnamic acid HA has been studied at 25°C in the solvent systems: methyl isobutyl ketone–H_2O and chloroform–H_2O solutions at a constant ionic strength of 0.1M. The complex formation in the aqueous phase between Th and the acids is described by two parameters. The Th complex extracted into the hexone solution of salicylic acid has been found to have an associated salicylic acid molecule. By comparison with methoxybenzoic acid it seems plausible to write the formula as $Th(HA)_4 . H_2A$. (auth)

9216

SEPARATION OF ZIRCONIUM FROM OTHER ELEMENTS BY LIQUID-LIQUID EXTRACTION. F. L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem. 28, 997-1001(1956) June.

The extraction behavior of Zr at both tracer and macro concentrations from aqueous solutions of HNO_3, HCl, and $H_2C_2O_4$ into 0.5M 2-thenoyltrifluoroacetone–xylene is described, as well as the separation of Zr from other elements. Peroxy complexing of Nb and Pa is particularly effective in achieving clean separations of these elements from Zr. Several general applications of this liquid-liquid extraction technique to problems involving the purification of radio Zr, the removal of radio Zr when present as an interference, the rapid determination of radio Zr in radioisotope and fission product solutions, and the separation of inactive Zr from interferences prior to its determination are discussed. (auth)

9217

ISOLATION AND MEASUREMENT OF URANIUM AT THE MICROGRAM LEVEL. Charles L. Rulfs, Anil K. De, and Philip J. Elving (Univ. of Michigan, Ann Arbor). Anal. Chem. 28, 1139-43(1956) July.

A double cupferron separation of U using extraction has been adapted to the micro level. Uranium(VI) does not extract in the first stage, which removes many potentially interfering elements. Uranium(IV), obtained in the residual aqueous solution by reduction at a mercury cathode, cathode, is simultaneously extracted as the cupferrate into ether, from which it can be re-extracted into nitric acid. A relatively simple one-piece glass apparatus is used for all operations. The U recovery at the milligram level in an initial 30-ml sample was determined colorimetrically as 94%. With 0.03 to 0.13 γ of radioactive U^{233} tracer and 20 γ of natural U as carrier, the recovery is 86%; the latter includes the additional step of electrodeposition of the U onto a platinum planchet prior to measurement by alpha counting, which is only 94% complete. The decontamination possible with this procedure was checked with 0.07 γ quantities of U^{233} in the presence of high mixed fission product activities; 85% recovery was obtained, containing only 0.9% of the fission product alpha activity (assumed to be U). (auth)

9218

ON THE ION-EXCHANGE OF URANIUM. Tatsujiro Ishimori and Hisateru Okuno. Bull. Chem. Soc. Japan 29, 78-82(1956) Jan.

From the experimental results on the ion exchange of uranium(VI), it was found that acetate solution is excellent for the elution in cation-exchange procedure; and that separation of uranium can be effected with sulfate solution in anion-exchange procedure. (auth)

9219

EXCHANGE OF SULFATE IONS IN BASIC CHROMIUM SULFATE SOLUTIONS. Yu. P. Nazarenko and Ya. A. Fialkov. (Inst. of General and Inorganic Chemistry). Doklady Akad. Nauk S.S.S.R. 107, 413-16(1956) Mar. 21. (In Russian)

9220

KINETICS OF NONAQUEOUS ION EXCHANGE SYSTEMS. HYDROGEN–BUTYLAMMONIUM EXCHANGE IN ETHANOL–WATER MIXTURES. Stafford Wilson and Leon Lapidus (Princeton Univ., N. J.). Ind. Eng. Chem. 48, 992-8(1956) June.

The adsorption of n-butylamine on the hydrogen form of Dowex 50 ion exchange resin was studied in a batch type reactor. Aqueous ethanol mixtures were used as solvents. Data were taken at varying amine and solvent concentrations, resin cross linkage, and resin particle size. The rate of reaction was found to be particle diffusion controlled and could be varied several thousandfold by changes of solvent composition. The use of theoretical equations originally derived for aqueous systems was found to correlate the rate data. Diffusivities calculated by the theoretical equations may be used to characterize the nonaqueous rate process. (auth)

9221

ANION-EXCHANGE STUDIES. XXI. Th(IV) AND U(IV) IN HYDROCHLORIC ACID. SEPARATION OF THORIUM, PROTACTINIUM AND URANIUM. Kurt A. Kraus, George E. Moore, and Frederick Nelson (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 2692-5(1956) June 20.

The anion-exchange behavior of Th^{4+} and U^{4+} in HCl solutions was investigated with a strong base quaternary amine resin. Adsorbabilities of these two elements are surprisingly different. Thorium(IV) ion shows no adsorption throughout the HCl concentration range studied (0.1 to 12M); U^{4+} shows negligible adsorption below 5.5M HCl and rapidly increasing adsorbability at higher concentrations. The ion-exchange behavior of these elements is compared with that of other elements of oxidation number four. An anion-exchange method for the separation of Th^{4+}, Pa^{5+}, and U^{4+} has been devised, as well as a method for the separation of U^{4+} and U^{6+}. (auth)

9222

USE OF GAS PHASE CHROMATOGRAPHY FOR THE SEPARATION OF MIXTURES OF CARRIER FREE RADIOACTIVE SUBSTANCES; PRODUCTS OF CHEMICAL REACTIONS ACTIVATED BY NUCLEAR PROCESSES. James B. Evans and John E. Willard (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 78, 2908-9(1956) June 20.

9223

PRECIPITATION OF METAL FROM SALT SOLUTION BY REDUCTION WITH HYDROGEN. F. A. Schaufelberger (Ciba States Ltd., New York). J. Metals 8, 695-704(1956) May.

Early work on chemical precipitation of metals from metal salt solutions is reviewed. The chemistry and thermodynamics of precipitating copper, nickel, cobalt, and cadmium metals by reaction with hydrogen are discussed. Mechanisms of metal precipitation, nucleation, growth, and agglomeration are reviewed, as well as some solubility phenomena of gases and solids at elevated temperatures. Experimental data presented deal mainly with the reaction of copper sulfate solution with H_2. (auth)

9224

THERMAL DIFFUSION NEAR THE CRITICAL SOLUTION TEMPERATURE. L. J. Tichacek and H. G. Drickamer (Univ. of Illinois, Urbana). J. Phys. Chem. 60, 820-1(1956) June.

Thermal diffusion measurements were made on the isooctane–perfluoroheptane system in the temperature range, 25 to 45°C. Results are compared with calculated values. (C.W.H.)

9225
SYNTHETIC ION-EXCHANGERS. RECENT DEVELOPMENTS IN THEORY AND APPLICATION. G. H. Osborn. London, Chapman, and Hall Ltd., 1955. 419p.

9226
SEPARATION OF $^{14}C^{16}O$ AND $^{12}C^{18}O$ BY THERMAL DIFFUSION. A. E. De Vries, A. Haring, and W. Slots. Physica 22, 247-8(1956) Mar.

9227
THE EXTRACTION OF NITRATES BY TRI-n-BUTYL PHOSPHATE (TBP). PART 2. THE NATURE OF THE TBP PHASE. T. V. Healy and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, England). Trans. Faraday Soc. 52, 633-42(1956) May.

Evidence is presented pointing to the conclusion that nitrates are extracted by TBP in the neutral, unionized form, always solvated by a definite number of TBP molecules, e.g. $Ce(NO_3)_3 . 3TBP$, $UO_2(NO_3)_2 . 2TBP$; the compounds formed are sometimes hydrated, sometimes almost unhydrated. The evidence is much fuller for uranyl than for any other nitrate, but all the data support this general conclusion. (auth)

9228
ION EXCHANGE IN URANIUM PRODUCTION. T. V. Arden. Nuclear Eng. 1, 68-71(1956) May.

Ion exchange has been adapted for U extraction from low-grade ores. The simplicity and cheapness of the process has resulted in the quantity production of U from mines where low concentration previously made the ore unworkable. Clarified acid leach liquor passes through the basic anion exchange resin. When the resin is loaded, U is eluted by acidified metallic salt solution precipitated with an alkali thickened to an oxide cake of about 90% U. (F.S.)

Refer also to abstract 9196.

SORPTION PHENOMENA

9229 AERE-C/M-280
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ISOTHERM FOR THE ADSORPTION OF KRYPTON ON CHARCOAL. D. F. Sangster. June 1956. 7p.

The isotherms for the adsorption of Kr on charcoal at −40 to 0°C have been calculated from chromatographic data. The isotherm is non-linear above and absorption of about 4 cm^3 NTP (0.2 millimoles) of gas per gm of charcoal. (auth)

SYNTHESES

9230 NBS-2812
National Bureau of Standards, Washington, D. C.
ELECTRODEPOSITION OF BERYLLIUM. Progress Report [for] July 1, 1953 to September 30, 1953. Gwendolyn B. Wood and Abner Brenner. Sept. 30, 1953. 9p. NBS Project 0506-10-3262. (AD-24306). $3.30(ph OTS); $2.40(mf OTS).

Apparatus for the preparation of beryllium dimethyl was assembled and proved to be satisfactory. Three separate runs have been carried out. Because of the time consumed in the preparation, the capacity of the equipment was enlarged for each successive run. Assuming 100% yields the three runs involved the preparation of 1.4, 4.1, and 6.8 moles of Be dimethyl. (auth)

9231 UCRL-3214
California. Univ., Berkeley. Radiation Lab.
THE PREPARATION OF LEUCYLALANINE-2-C^{14}. Rosemarie Ostwald. May 10, 1956. 8p. Contract W-7405-eng-48. $0.15(OTS).

L-Leucyl-DL-alanine-2-C^{14} with a specific activity of 2.5 μc/mg was prepared in an over-all yield of 22% from alanine-2-C^{14}. Thirty-three percent of the starting activity was recovered as DL-alanine-2-C^{14}. A byproduct of the reaction in a yield of 22% was tentatively identified as an intra- or intermolecular anhydride of the peptide. (auth)

9232
SOME METHYLHYDRAZONIUM SALTS; AN IMPROVED SYNTHESIS OF TETRAMETHYLHYDRAZINE. Robert T. Beltrami and Eugene R. Rissell (Univ. of California, Livermore). J. Am. Chem. Soc. 78, 2467-8(1956) June 5.

1,1-Dimethyl-2-formylhydrazine, 1-formyl-1,2,2-trimethylhydrazine, pentamethylhydrazonium iodide and bromide, 1-formyl-2,2,2-trimethylhydrazonium iodide and 1-formyl-1,2,2,2-tetramethylhydrazonium iodide have been synthesized. A new synthesis of trimethylhydrazine and tetramethylhydrazine is reported. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

9233 CRC-636
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
SOME EXPERIMENTS RELATED TO THE PROCESSING OF PLUTONIUM−ALUMINUM ALLOY BY HIGH TEMPERATURE METHODS. D. E. McKenzie, J. W. Fletcher, and T. Bruce. Apr. 1956. 13p. (AECL-310).

A number of high temperature methods have been investigated for the decontamination of Pu−Al alloys from fission products. The methods include oxidative slagging, treatment of the alloy with molten Pb, Tl, or cryolite, and solution of the alloy in PbF_2−NaF mixtures. Of these techniques, the simplest and most effective is the treatment of the molten alloy with molten cryolite. The fission products Sr and Ce can be removed but Zr and Ru remain in the Al phase with essentially all of the Pu. (auth)

9234 CRC-639
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE EXTRACTION OF PLUTONIUM FROM PLUTONIUM−ALUMINUM ALLOYS BY MOLTEN BISMUTH. D. E. McKenzie, J. W. Fletcher, and T. Bruce. Apr. 1956. 13p. (AECL-314)

The distributions of Pu, Am and certain fission products between neutron-irradiated Al−Pu alloys and molten Bi have been examined in small scale experiments. An equal volume of Bi extracts 78% of the Pu, 93% of the Am, the majority of the fission product Ce, but essentially no Ru or Zr from the Al phase. The fraction of Pu in the Bi phase decreases slightly with increasing temperature in the range 800 to 1050°C but is independent of the Pu concentration. A possible process, utilizing these results, is discussed. (auth)

9235
ISOTOPIC EXCHANGE BETWEEN Pu(III) AND Pu(IV). Thomas K. Keenan (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 2339(1956) May 20.

Studies were initiated on the exchange reaction between Pu^{3+} and Pu^{4+} in $HClO_4$ solutions at 0°C. The rate of exchange in 0.5 formal is approximated by the equation, $R = k^1 (III) (IV)$, where $k^1 = 1.10 \pm 0.10 \times 10^4$ liter/mole/min. (C.W.H.)

9236
CRYSTAL STRUCTURE AND MAGNETIC SUSCEPTIBILITY OF AMERICIUM METAL. Peter Graf, B. B. Cunningham, Carol H. Dauben, J. C. Wallmann, D. H. Templeton, and

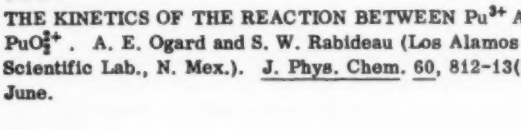
Helena Ruben (Univ. of California, Berkeley). J. Am. Chem. Soc. 78, 2340(1956) May 20.

The x-ray diffraction powder patterns of Am were indexed as double hexagonal closed packed, a = 3.642 ± 0.005 A, and c = 11.76 ± 0.01 A. The space group is D^4_{6h} and the atomic positions are: two Am in (0, 0, 0), (0, 0, ½); two Am in (⅓, ⅔, ¾), (⅔, ⅓, ¼). The Am radius is 1.82 A and the calculated density 11.87 ± 0.05 g/cm³. (auth)

9237

THERMODYNAMIC FUNCTIONS AND FORMAL POTENTIALS OF THE PLUTONIUM(V)-(VI) COUPLE. Sherman W. Rabideau (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 2705-7(1956) June 20.

The formal potentials of the Pu couples in 1M $HClO_4$ at 25.00°C are:



(auth)

9238

FLUORESCENCE SPECTRUM OF Pu^{3+} IN $LaCl_3$. B. B. Cunningham, John G. Conway, and Ralph D. McLaughlin (Univ. of California, Berkeley) and D. M. Gruen (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 24, 1275(1956) June.

9239

THE KINETICS OF THE REACTION BETWEEN Pu^{3+} AND PuO_2^{2+}. A. E. Ogard and S. W. Rabideau (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 60, 812-13(1956) June.

TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 9460.

URANIUM AND URANIUM COMPOUNDS

9240 AERE-C/R-1805

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF NIOBIUM AND MOLYBDENUM IN URANIUM TERNARY ALLOYS. G. W. C. Milner, G. A. Barnett, and A. Bacon. Dec. 23, 1955. 15p.

The determination of Nb (from 2 to 30%) in U base alloys containing more than 60% of U and from 5 to 20% of Mo is accomplished by a preliminary solvent extraction. Niobium is extracted into hexone from a 10M HF, 6M H_2SO_4, 2.2M NH_4F solution of the sample and then recovered from the hexone by extraction into aqueous H_2O_2. The combined aqueous fractions are evaporated to fumes of H_2SO_4 and Nb is separated from most of the co-extracted Mo by precipitation with NH_3. After re-solution in HCl, niobium is precipitated with tannic acid from 2N HCl. The precipitate is removed by filtration and the determination completed gravimetrically by igniting to Nb_2O_5. The Mo content is determined on a separate portion of the sample after solution in HNO_3 and HF and evaporation to fumes of H_2SO_4. The colored Mo thiocyanate complex is formed on a suitable aliquot of this solution and its absorbancy measured against a suitable Mo standard treated in the same way. Hydrolysis of Nb from solution is prevented by complexing with $H_2C_2O_4$. This high precision spectrophotometric method enables the Mo content to be determined with a precision of about 0.5% (1 σ level). (auth)

9241

STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XVI. DISTRIBUTION STUDIES ON THE COMPLEX FORMATION OF U(VI) WITH SALICYLIC ACID AND METHOXYBENZOIC ACID. Brita Hök-Bernström (Research Inst. of National Defence, Sundbyberg, Sweden and Univ. of Stockholm, Sweden). Acta Chem. Scand. 10, No. 2, 163-73(1956).

The complex formation of UO_2^{2+} and salicylic acid, H_2A, has been studied by means of distribution data. The solvent system was hexone −0.1M $NaClO_4$ and the temperature 25°C. The UO_2^{2+} concentration was varied between 10^{-3} and 5×10^{-5}M, while the salicylic acid concentration was varied between 1 and 10^{-2}M. The results indicate that the predominant species in the hexone phase are $UO_2(H_2A)_2(H^+)_{-2}$ and $UO_2(H_2A)_3(H^+)_{-2}$. Complexes formed in appreciable amounts in the aqueous phase in the pH-range 3 to 5 seem to be $UO_2(H_2A)(H^+)_{-1}$ and $UO_2(H_2A)(H^+)_{-2}$. Comparative experiments were run with methoxybenzoic acid (HB). The extractable complex is UO_2B_2. In the aqueous phase $UO_2(B)(OH)$ seem to form. The equilibrium constants for the formation of these uranyl complexes are tabulated. (auth)

9242

THE DISTRIBUTION OF PLUTONIUM IN THE SYSTEMS URANIUM – SILVER AND URANIUM – SILVER – GOLD. D. E. McKenzie (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem. 34, 749-56(1956) June.

The distribution of plutonium between molten silver and molten neutron-irradiated uranium has been examined in small-scale experiments. The fraction of plutonium in the silver layer increases with increasing temperature. For equal weights of silver and uranium containing 0.1% plutonium, 88% of the total plutonium is distributed to the silver phase at 1350°C. Greater proportions of plutonium are found in the silver phase in experiments with uranium of lower initial plutonium concentration. On the addition of gold to the system plutonium extraction is increased and passes through a maximum. This maximum appears to be associated with a particular concentration of gold in silver and of gold in uranium. (auth)

9243

URANIUM OXIDE FROM ORES—WITH SIX PROCESS FLOWSHEETS. Arthur Linz. Chem. Eng. Progr. 52, 205-9(1956) May.

Process flowsheets for the recovery of U (as UO_3) and V from U–V ores are outlined. The salt roasting process is widely used in the uranium ore processing plants. (C.W.H.)

9244

ELECTROREFINING FOR REMOVING FISSION PRODUCTS FROM URANIUM FUELS. Leonard W. Niedrach and Arthur C. Glamm (Knolls Atomic Power Lab., Schenectady, N. Y.). Ind. Eng. Chem. 48, 977-81(1956) June.

The possibility of reducing the cost of reprocessing fuel from nuclear reactors by employing electrorefining is considered. This process for decontaminating uranium from fission products is described. Alloys of U with transition metals are used to obtain molten products at temperatures below the melting point of U. The effect of temperature in the range 980 to 1080°C. on cell efficiency and operation is negligible. For high efficiency low anode current densities are desirable. Bath composition has little effect on cell operation, but excessive codeposition of the bath diluent occurs if the U concentration is too low. Decontamination factors between 80 and 500 have been obtained for representative fission products. The general feasibility of the proposed electrorefining process has been demonstrated and the need for additional development work is indicated. (auth)

9245

THE PREPARATION OF $UClF_3$. Albert W. Savage, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 2700-2(1956) June 20.

9246

ORGANIC COMPOUNDS OF URANIUM. I. 1,3-DICAR-

BONYL CHELATES. H. Gilman, R. G. Jones, E. Bindschadler, D. Blume, G. Karmas, G. A. Martin, Jr., J. F. Nobis, J. R. Thirtle, H. L. Yale, and F. A. Yoeman (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 2790-2(1956) June 20.

9247

SALICYLAMIDOXIME AS AN ANALYTICAL REAGENT. PART III. SPECTROPHOTOMETRIC DETERMINATION OF URANIUM. Debabrata Bandyopadhayay. J. Indian Chem. Soc. 33, 269-75(1956) Apr.

The use of salicylamidoxime as a reagent for the spectrophotometric determination of U, by making use of the orange-yellow color formed by U^{6+} with the reagent in alkaline solution, is described. The optimum wave-length for measurement of the color intensity is 400 mμ; the pH of the solution should be within the limit of 7.9 to 9.2, and an excess of the amidoxime, at least 7 times the molar proportion of U, is essential. The color is stable at room temperature and its intensity is independent of temperature within the range of 20 to 25°C, but measurements can safely be carried out at temperatures up to 30°C. Beer's law holds good within the range of 7 to 145 ppm of U, and sensitivity is 0.12 $\gamma\ cm^{-2}$. The composition (1:1) of the colored species has been evaluated and the probable constitution has been assigned. Most cations and anions interfere with the determination of U. Hence, a preliminary separation of U from the interfering ions is essential as in most other cases. (auth)

9248

PRODUCTION OF URANIUM METAL. D. S. Arnold, C. E. Polson, and E. S. Noe (National Lead Co. of Ohio, Fernald). J. Metals 8, 637-9(1956) May.

Various process steps involved in the recovery and purification of U for reactor fuel elements are discussed. (F.S.)

9249

THE REDUCTION OF URANIUM(VI) BY IRON(II) IN PHOSPHORIC ACID SOLUTION. C. F. Baes, Jr. (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 805-6(1956) June.

Refer also to abstracts 9159, 9163, 9166, 9217, 9218, 9221, and 9370.

WASTE DISPOSAL

9250 CRB-658

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

REPORT ON WASTE DISPOSAL SYSTEM AT THE CHALK RIVER PLANT OF ATOMIC ENERGY OF CANADA LIMITED. C. A. Mawson. July 1956. 16p. (AECL-344). $0.50(AECL).

Disposal methods now in use at the Chalk River Project are presented. Also discussed are new methods proposed and on test for disposal of waste. (W.L.H.)

9251

EFFECTS OF HIGH CONCENTRATIONS OF NITROGEN ON ACTIVATED SLUDGE. Robert L. Taylor, Everett R. Mathews, and C. W. Christenson (U. S. A. E. C. Operation Office, San Francisco and Sante Fe and Los Alamos Scientific Lab., N. Mex.). Sewage and Ind. Wastes 28, 177-82(1956) Feb.

High concentrations of nitrate nitrogen, added to activated sludge over periods of time permitting acclimation did not inhibit sludge growth or the normal metabolic processes, while, under similar conditions, high concentrations of ammonium nitrogen caused deterioration of activated sludge effluents. It is inferred that ammonium nitrogen may have been the cause of occassional malfunctions in the waste treatment plant. (C.W.H.)

ENGINEERING

9252 LA-1963

Los Alamos Scientific Lab., N. Mex.

RESEARCH ON A HIGH CURRENT BATTERY. MacPherson Morgan, A. E. Schofield,—V. Josephson, ed. Aug. 1955. 44p. [Contract W-7405-eng-36]. $0.25(OTS).

Exploratory work has been performed on lead-acid batteries to verify peak pulsed current values obtained by Kapitza in 1924, to determine the maximum value of pulsed current obtainable by this method, and to explore the practicality of such batteries as energy sources for large pulsed currents for millisecond periods. Results obtained thus far indicate that usable units can be built and charged which will produce consistently (day to day) peak currents of ~4.7 amp/cm^2 which is ~20% better than Kapitza's value. Further, the cells present no serious problem in construction and charging, but do require some thought as to suitable switches for handling such large currents at low voltages which can be achieved by this method. (auth)

9253 NP-5956

Shell Development Co., Emeryville, Calif.

AN INVESTIGATION OF GREASE LUBRICATION PHENOMENA IN OPEN, SHIELDED AND SEALED ANTI-FRICTION BEARINGS. (Cover carries title: GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS). Sixth Quarterly Progress Report for December 1955 through February 1956. John B. Accinelli and Paul H. Williams. 21p. Contract AF33(616)-2443. (S-13679).

A change in housing design of the 20 mm rigs resulted in improved performance with oil–air mist lubrication but not with grease lubrication. In one test with grease, the bearing operated for 109 hours at 1.0×10^6 DN but this result could not be duplicated in six additional attempts under ostensibly identical conditions. It is believed that this one long test was the result of a fine degree of dynamic balancing achieved by a fortunate combination of mechanical factors and demonstrates the importance of mechanical factors in high speed bearing performance with grease lubrication. Grease lubrication of very high speed bearings appears to be very sensitive to mechanical factors. Additional work at 1.0×10^6 DN on the effect of the viscosity of the oil in the grease in the 20 mm rig with the new housing again indicated the beneficial effect of the heavier viscosity oil. These tests also indicated a disadvantage when using a fibrous gelling agent such as a sodium stearate soap. The "sticky" grease caused large variations in speed at initial start-up which could result in bearing separator damage if bearing operation is allowed to continue under these conditions. Operating with bearings "plated" with thin films of grease (bearings dipped in grease dispersed in solvents and oven dried) resulted in good performance at start-up but short operating life. The thin grease film allowed quick acceleration to speed with very few large variations in speed but did not provide sufficient lubricant at the critical sliding surfaces to prevent early bearing failure. (auth)

9254 NP-6062

Mine Safety Appliances Co., Callery, Penna.

THE USE OF IMPURE INERT GAS WITH SODIUM. Memo Report No. 81. R. C. Werner. Apr. 14, 1955. 5p. Contract NObs-65426.

Before the purity specification of the inert gas is relaxed it is recommended that studies be made on the effect of local corrosion resulting from high oxygen concentration formed on draining, on the effect these sludge formations can have on valve seats, bellows valves, and other moving parts and on determining the ratio of corrosion between the walls of the main loop and the cold trap based

on the operational schedule and rate of oxide removal of the cold trap. The purification specifications of the inert gas may then be relaxed following the knowledge on the extent of the resulting problems. (auth)

9255 NP-6071

Midwest Research Inst., Kansas City, Mo.

INVESTIGATION OF THE NATURE OF THE FRICTION FORCES IN LAMINAR SOLID LUBRICATION. Final Report [for] December 1, 1955–May 31, 1956. Melvin T. Lavik. 24p. DA Project 5B99-01-004. Contract DA-23-072-ORD-596.

The frictional behavior of WS_2 is very similar to that MoS_2. The buildup in the coefficient of friction with standing time for WS_2 follows the same pattern as does MoS_2 and is dependent on temperature. In addition, the decrease in the coefficient of friction of WS_2 with running time approaches an asymptotic value as does MoS_2. With these essential similarities between the frictional behavior of WS_2 and MoS_2, the conclusion must be that the same type of lubricating mechanism takes place. The coefficient of friction of WS_2 is essentially of the same order of magnitude as MoS_2 under similar vacuum conditions. (auth)

9256

SOME OPERATING CHARACTERISTICS OF THE PUMP-MIX MIXER SETTLER. J. H. Holmes and A. C. Schafer (Knolls Atomic Power Lab., Schenectady, N. Y.). Chem. Eng. Progr. 52, 201-4(1956) May.

The design principles of the pump-mix mixer settler are described briefly and some of its operating characteristics are presented. Advantages of the mixer settler include high efficiency, reliability of operation, simplicity of control, flexibility, ease of maintenance, and minimum investment. (C.W.H.)

9257

HIGH PRESSURE–HIGH TEMPERATURE UNIT FOR LIQUID-SOLID REACTIONS. William H. Dresher, Thomas M. Kaneko, W. Martin Fassell, Jr., and Milton E. Wadsworth (Univ. of Utah, Salt Lake City). Ind. Eng. Chem. 47, 1681-5(1955) Sept.

A high pressure-high temperature reaction unit has been designed and constructed for the study of rate processes of heterogeneous reactions at the solid-aqueous solution interface. Provisions have been made for the introduction of solid samples of known surface area as well as for the extracting of liquid samples during the course of the reaction. The temperature and the pressure of the system are automatically regulated and indicated. A unique feature of the unit is an agitator drive assembly completely contained within a separately pressurized chamber in the autoclave. (auth)

HEAT TRANSFER AND FLUID FLOW

9258 AECU-3291

Knolls Atomic Power Lab., Schenectady, N. Y.

NATURAL CONVECTION HEAT TRANSFER IN NARROW VERTICAL LIQUID METAL ANNULI. C. F. Bonilla. Aug. 26 and Oct. 21, 1954. 16p.

Experiments on natural convection heat transfer from the bottom to the top of a rigid narrow annulus or vertical slot with insulating walls yield and approximate correlation $Nu_L = UL/k = q/kP\,\Delta t = 2.0 \pm 1.0$. (auth)

9259 UTIA-REV-3

Toronto. Univ. Inst. of Aerophysics.

AN INTRODUCTION TO THE GENERAL EQUATIONS OF FLUID DYNAMICS. G. N. Patterson. Dec. 1950. 77p.

The relevant portions of vector algebra and vector calculus used in developing the general equations of motion are first reviewed. Attention is also given to generalized coordinates so that the research student can make a suitable choice of coordinates for a particular problem. General forms are finally derived for the equation of motion. (auth)

9260

THE USE OF SODIUM AND OF SODIUM–POTASSIUM ALLOY AS A HEAT-TRANSFER MEDIUM. I. W. B. Hall and T. I. M. Crofts (United Kingdom Atomic Energy Authority, Sellafield, England). Atomics 7, 167-72(1956) May.

The applications of liquid metals in heat-transfer problems are discussed, and comparisons are drawn between those metals whose melting points are sufficiently low to make them of interest in this respect. A number of Na and Na-K circuits which have been built and operated over the past three years are described; some of these were built in order to gain experience in handling the liquid metals, while others were for heat-transfer experiments. A general discussion on the design and construction of liquid metal circuits and the components which are commonly used in them is given. A brief discussion of forced-convection heat-transfer with liquid metals follows, and the results of some work on cavitation in Na-K eutectic flowing through a constriction in a pipe are summarized. (auth)

9261

GAS FLOW PAST BODIES AT HIGH SUPERSONIC SPEED. G. G. Chernyĭ. Doklady Akad. Nauk S.S.S.R. 107, 221-4(1956) Mar. 11. (In Russian)

$M \to \infty$ flow past variously shaped bodies tends to find its finite state. The blunter the front of the body the faster the finite state can be reached. Such finite state of motion for which $M^2\cos^2(n,\chi) \gg 1$, where $\cos(n,\chi)$ is the cosine between the direction of the incoming flow and the normal to the surface of the body is called the supersonic flow. A method is offered for calculation of the hypersonic flow of a perfect gas with constant heat capacity over axially symmetrical bodies and flat contours. The method is based on decomposition of sought-for solution according to the order of powder $\epsilon = \gamma - 1/\gamma + 1$, where γ is the ratio of specific heats, and coincides with the disintegration method according the order of power 1/Re (Re is the Reynolds number) found in viscous fluid flow equations in the theory of boundary layer. (The boundary layer theory produces the first member of the order.) (R.V.J.)

MATERIALS TESTING

9262 NP-6065

Langley Aeronautical Lab., Langley Field, Va.

EXPERIMENTAL RESEARCH ON AIRCRAFT STRUCTURES AT ELEVATED TEMPERATURES. Joseph N. Kotanchik. May 1956. 36p.

The equipment and methods used at the Langley Laboratory of the NACA in experimental research on aircraft structures at elevated temperatures are reviewed. The equipment ranges from conventional steady-state furnaces for stress-strain tests to transient radiant-heating apparatus and aerodynamic heating and loading in a supersonic air jet. (auth)

9263 WADC-TR-55-221(Pt. 2)

Hooker Electrochemical Co., Niagara Falls, N. Y.

INVESTIGATION OF CONDENSATION TYPE ELASTOMERS. [Period covered] June 1, 1955 to December 1, 1955. George C. Schweiker, Russell R. White, and Rudolph N. Deleo. May 1956. 70p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-2421.

With this is bound, under Subcontract to AF33(616)-2421: Purdue Univ., Lafayette, Ind. FLUORINE CON-

TAINING MONOMERS FOR CONDENSATION POLYMERS. Summary Progress Report No. 2 [for] May 1, 1955 to December 1, 1955. Earl T. McBee and Carleton W. Roberts.

A number of linear polyesters were prepared from F_2-containing diols and various decarboxylic acid chlorides and their properties determined. Hexafluoropentylene adipate exhibited increased tensile strengths when reinforced with carbon black; also it is thermally stable to 350°F, very resistant to aromatic fuels and other fluids, and is not brittle at −65°F or lower. Satisfactory methods were developed for the preparation of 3-perfluoropropylglutaric and 3,5-bis(perfluoropropyl)-4-thiapimelic acids and their derivatives. (For preceding period see WADC-TR-55-221(Pt. 1).) (C.W.H.)

VACUUM SYSTEMS

9264 AEC-tr-2554
EXPERIENCE WITH METAL FOIL AS HIGH VACUUM SEALS. Heinrich Hintenberger. Translated from Z. Naturforsch. 6a, 459-62(1951). 7p.

Experience with soluble and heat resistant vacuum tight flange combinations are described with metal sheets, particularly Al, used as sealing foil. The form and dimensions of the flange and the treatment of the sealing foil are cited, which, when reliably sealed could be used for years. Aluminum sheet between brass flanges can be heated up to 280°C without leaking. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

9265
THE GROWTH OF DISPERSED PRECIPITATES IN SOLUTIONS. G. W. Greenwood (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Met. 4, 243-8 (1956) May.

When dispersed particles of a second phase exist in a saturated solution, there is a tendency for smaller particles to dissolve and larger ones to grow, by the transfer of solute through the solvent from particle to particle. The driving force is derived from the consequent reduction in total interfacial energy. This process is analysed theoretically in terms of a resultant diffusion flow from the smaller to the larger particles, and formulae are derived for the rate of change of particle size. The theory is applied to the particular case of the growth of solid particles dispersed in a liquid solution and shown to agree in order of magnitude with observed rates of growth in U−Pb and U−Na slurries. (auth)

CERAMICS AND REFRACTORIES

9266 AD-62531
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 7 for the Period March 1, 1955 to April 1, 1955. Harry C. Dunegan. Apr. 1955. 11p. Contract AF33(600)-27329.

9267 AD-66728
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 9 for the Period May 1, 1955 to June 1, 1955. Harry C. Dunegan. June 1955. 13p. Contract AF33(600)-27329.

9268 AD-67026
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 10 for the Period June 1, 1955 to July 1, 1955. Harry C. Dunegan. July 1955. 12p. Contract AF33(600)-27329.

9269 AD-69621
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 11 for the Period July 1, 1955 to August 1, 1955. Harry C. Dunegan. Aug. 1955. 14p. Contract AF33(600)-27329.

9270 AD-75133
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 12 for the Period August 1, 1955 to September 1, 1955. Harry C. Dunegan. Sept. 1955. 12p. Contract AF33(600)-27329.

9271 AD-87673
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 2 for the Period October 1, 1954 to November 1, 1954. Harry C. Dunegan. Nov. 1954. 18p. Contract AF33(600)-27329.

9272 AD-87674
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 3 for the Period November 1954 to December 1, 1954. Harry C. Dunegan. Dec. 1954. 22p. Contract AF33(600)-27329.

9273 AD-87675
American Lava Corp., Chatanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 4 for the Period December 1, 1954 to January 1, 1955. Harry C. Dunegan. Dec. 1954. 12p. Contract AF33(600)-27329.

9274 AD-87676
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 5 for the Period January 1, 1955 to February 1, 1955. Harry C. Dunegan. Feb. 1955. 14p. Contract AF33(600)-27329.

9275 AD-87677
American Lava Corp., Chattanooga.
A STUDY AND EVALUATION OF METHODS OF PRODUCING A CERAMIC-TO-METAL SEAL BY PRESSED POWDER TECHNIQUES FOR AUTOMATIC MASS PRODUCTION. Report No. 17 for Period January 1, 1956 to February 1, 1956. Harry C. Dunegan. Feb. 1956. 19p. Contract AF33(600)-27329.

Thermal expansion curves were obtained for alumina and spinel−alumina ceramics containing additions of nickel

oxide, chromium oxide, manganese dioxide and iron oxide. The thermal expansion curve for a 45 wt.% spinel–alumina mixture containing 20 wt.% chromium oxide was practically identical to the curve obtained for Type NTR alloy containing 10 wt.% iron oxide. Successful seals were not possible with this ceramic–metal iron oxide. Successful seals were not possible with this ceramic–metal system because of the excessive firing shrinkage of the metallic layer. Ceramics containing a layer of a metal oxide (either Fe, Cr or Ni), were fired in air to develop a bond and refiring in hydrogen to reduce the "surface" oxides to the metallic state. The volume decrease accompanying the reduction of the oxide ruptured the layers. Alumina and spinel–alumina calcines matured in vacuum caused pressure increases identical in nature to the dew point increases observed during the hydrogen atmosphere firings of these same bodies. (auth)

9276 WADC-TR-55-327
Firth Sterling, Inc., Pittsburgh.
AN INVESTIGATION OF THE FEASIBILITY OF PRODUCING METAL BONDED CARBIDE BODIES BY THE EXTRUSION PROCESS. [Period covered] July 1952 to May 1955. William W. Wellborn. Dec. 1955. 38p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-229.

The purpose of this investigation was to determine if useful metal-bonded carbide objects could be produced by the extrusion process. A further aim was the comparison of the properties of such objects as might be produced by extrusion, with the properties of objects of the same composition produced by pressing, shaping, and sintering. The principal equipment used was a 1050-ton extrusion press, which had been built to extrude carbide charges. The investigation revealed that it was possible to extrude these bodies into some shapes. However, shapes with irregular cross sections, or thin sharp edges, were extremely difficult to extrude and it was impossible to hold size. The physical properties of extruded material were found to be measurably lower than materials compacted by conventional means. The incidence of flaws in extruded material was found to be greater. (auth)

9277
ON THE RATE OF SINTERING. Gerhard Bockstiegel (Sintermetallwerk Krebsöge, GmbH, Krebsöge, Germany). J. Metals 8, 580-5(1956) May.

Kuczynski's formula has been derived for the case of nonspherical particles. Two formulas of Kuczynski's type have been derived, one describing the increase in tensile strength, the other describing the progress of shrinkage of a powder compact. It has been shown that the exponents of all three formulas each contain two magnitudes of different physical characters, viz, the geometrical factor α and the kinetic factor β. The interrelationships between the three exponents are stated. (auth)

9278
CERAMIC FUEL MATERIALS FOR NUCLEAR REACTORS. J. R. Johnson (Oak Ridge National Lab., Tenn.). J. Metals 8, 660-4(1956) May.

Ceramics that take advantage of the high power densities and high temperatures potentially available in nuclear reactors are being studied as reactor construction material. Properties of graphites, oxides, carbides and concretes, which have been used, are listed. (F.S.)

9279
PRODUCTION OF TRANSITION METAL DIBORIDES AND THEIR SOLID SOLUTIONS FROM METAL OXIDES AND BORON OXIDE. Herman Blumenthal (Schwarzkopf Development Corp., Yonkers, N. Y.). Powder Met. Bull. 7, 79-81 (1956) Apr.

A simple and inexpensive process for the production of some transition metal diborides and solid solutions of diborides is described. It is believed that this production procedure could be developed into a continuous process, if the necessity for the manufacture of these products on a large scale should arise in the future. (auth)

9280
POWDER METALLURGY OF THORIUM HYDRIDES. Samuel Storchheim (Martin Co., Baltimore). Powder Met. Bull. 7, 158-62(1956) Apr.

From a study of the powder metallurgy of ThH_2 and ThH_4, it is conceivable that hydride powders can complete economically with compacts made from pure Th starting powder. ThH_2 compacts to higher densities than ThH_4 but ThH_4 is easier to handle even though it takes an extra step in the fabrication cycle. (F.S.)

CORROSION

9281 BMI-1120
Battelle Memorial Inst., Columbus, Ohio.
EFFECT OF HYDROGEN PICKUP ON CORROSION BEHAVIOR OF ZIRCONIUM IN WATER. Charles M. Schwartz and Dale A. Vaughan. Aug. 1, 1956. 20p. Contract W-7405-eng-92. $0.25(OTS).

The pickup of H by Zr during exposure to 750°F steam was determined. The amount of H picked up appeared to be in proportion to the amount of corrosion as determined by weight-gain measurement. Metallographic study of cross sections after exposure of Zr to 750°F steam revealed the growth of hydride needles. Incipient formation of a hydride layer between the metal and the oxide was observed in crystal-bar Zr specimens after they had been exposed 180 hr to 750°F steam. Hydrogen content of Zr was shown to have little or no effect on its corrosion behavior providing the surface through which H has diffused was removed. The corrosion resistance of Zircaloy 2 surfaces, impregnated with hydrogen prior to exposure to 750°F steam, was decreased in proportion to the amount of H added. (auth)

9282 K-1135
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
THICKNESS MEASUREMENTS OF THIN FILMS BY MULTIPLE-BEAM INTERFEROMETRY. T. W. Bartlett and Frances L. Ball. June 16, 1954. 12p. Contract W-7405-eng-26. (KLI-1425). $0.20(OTS).

A brief discussion of Fizeau fringes and fringes of equal chromatic order is followed by data on the thickness measurement of thin films of Ag, barium stearate, and collodion by means of fringes of equal chromatic order. Measurements were made on films ranging in thickness from about 100 to 2000 A with a probable accuracy of 15 to 30%. (auth)

9283 LA-2028
Los Alamos Scientific Lab., N. Mex.
MATHEMATICAL ANALYSIS OF GALVANIC CORROSION. PART VIII. ALTERNATING SYSTEM OF ELECTRODES WITH INTERPOSED INSULATORS. James T. Waber and John M. Ruth. Apr. 16, 1956. 14p. Contract W-7405-eng-36. $0.20(OTS).

This report deals with coplanar electrodes and interposed insulators. As the first distinction, the electrodes are arranged periodically so that the edge effects are eliminated at the boundary of the cathode more remote from the anode-insulator junction. Another distinguishing feature is the consideration of finite depth of electrolyte as a separate case. The formal expression for the potential throughout the corrodent is derived. Although the interfacial potential is expressed in terms of tabulated values of the elliptic integral, no discussion of regions of converg-

ence of the formal expression is presented. The distribution of current density over the anode is expressed in terms of a simple trigonometric formula. The integrated current density was shown to be proportional to the ratio (K/K') of the complete elliptic integrals. (auth)

9284 NRL-Memo-591
Naval Research Lab., Washington, D. C.
THE TRANSFER RATES OF RADIOACTIVE STAINLESS STEEL COMPONENTS IN SODIUM CONTAINING BARIUM. Final Report. R. A. Baus, A. D. Bogard, J. A. Grand, L. B. Lockhart, and D. D. Williams. Apr. 17, 1956. Project No. NS 200-021.

The effect of Ba on the transfer rates of Fe, Co, Ta, Mn and impurities in radioactive stainless steel at 425°C was measured with 0, 0.1, 1, and 10 wt.% Ba added to the Na. Type 347 stainless steel apparatus and radioactive sources were used. The presence of less than 1 wt.% Ba in Na containing 0.001 to 0.003 wt.% O_2 is effective in reducing the transfer rates of Fe^{59}, Ta^{181}, and Co^{60}. The transfer rate of Mn^{54} was not significantly reduced. (auth)

9285 WADC-TR-54-527
The United States Stoneware Co., Tallmadge, Ohio.
THE DEVELOPMENT OF A PROTECTIVE COATING RESISTANT TO NITRIC ACID AND HYDROCARBONS. D. F. Siddall, H. L. Cahn, E. Hillier, and M. Gunther. Feb. 1956. 102p. Project Title: FINISHES AND MATERIALS PRESERVATION. Task title: ORGANIC PROTECTIVE COATINGS. Contract AF-33(616)-150.

Numerous film-forming raw materials from solvent systems and nonvolatile filleting compounds were screened for their resistance to white fuming nitric acid. Results show fluorocarbon resin X-200 is the only available resin meeting this contract requirement for coating and filleting compounds. Air dry, force dry or low temperature bake coatings have been tentatively formulated to provide the required protection. Studies of physical and chemical properties in conjunction with the compounding of this resin indicate the need for additional work to provide a more practical drying cycle and work is being continued concerning this phase. Filleting compounds have been developed and tested to meet basic requirements. Further studies are being made with regard to equipment and manufacturing methods. Work on all phases, including the refinement of coatings, production procedures on filleting compounds, and final cycling tests are to be carried out. (auth)

9286
CORROSION TESTING OF ALUMINUM. PART I. HIGH VELOCITY TEST METHOD IN AQUEOUS SOLUTIONS. Sumner B. Twiss and Jack D. Guttenplan (Chrysler Corp., Detroit). Corrosion 12, 263t-6t(1956) June.

A technique of corrosion testing, accelerated by high-velocity rotation of the test specimen, was investigated in connection with a program for selecting corrosion inhibitors. Aluminum-clad zinc was tested in tap water and ethylene glycol solutions. Velocity had no effect and corrosion remained low at all velocities, but the type corrosion was the same for all velocities. (F.S.)

9287
THE SCALING OF TITANIUM AND TITANIUM-BASE ALLOYS IN AIR. Hal W. Maynor, Jr. and Roy E. Swift (Univ. of Kentucky, Lexington). Corrosion 12, 293t-304t(1956) June.

A preliminary study of the scaling characteristics in air of laboratory-produced Ti and Ti base alloys, and commercially-produced titanium and titanium-base alloys was conducted at temperatures of 1200, 1400, 1600, and 1800°F (650, 760, 870, and 980°C) in the time range of approximately 4 to 300 hours. A total of 43 Ti-base alloys, one commercial grade of Ti (RS-70), and AISI Type 302 stainless steel were scaled at each of these temperatures; two additional alloys were employed at temperatures of 1200 and 1600°F. Scales formed on a 4.02% Al–Ti alloy were studied in detail and a scaling mechanism was suggested; scales formed on a 4.03% Cr–Ti alloy and a 2.95% W–Ti alloy were studied in less detail. Scaling tendencies of Ti-base alloys, relative to Ti and stainless steel were evaluated on the basis of weight gain with time. Isothermal transitions in scaling rate were observed for Ti- and Ti-base alloys within the temperature range 1200 to 1600°F. (auth)

9288
USE OF CAPACITY MEASUREMENTS FOR THE STUDY OF OXIDE FILMS ON METALS. J. N. Wanklyn (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 177, 849-50(1956) May 5.

The results obtained with Zr alloys suggest capacity measurements as a useful method of studying the protective character, as distinct from the thickness of oxide films formed by corrosion and oxidation. The oxide film after "breakaway", time at which the film on alloys becomes less protective, on Zr consists of an outer penetrable cracked portion and an inner surface which controls the corrosion rate. (F. S.)

9289
ANODIC OXIDE FILMS. PART 5. KINETICS OF FORMATION OF ANODIC OXIDE FILMS ON NIOBIUM. SPACE CHARGE AND THE TAFEL SLOPE ANOMALY. Lawrence Young (Imperial Coll., London). Trans. Faraday Soc. 52, 502-14(1956) Apr.

9290
ANODIC OXIDE FILMS. PART 6. APPLICATION OF DEWALD'S THEORY TO NIOBIUM. Lawrence Young (Imperial Coll., London). Trans. Faraday Soc. 52, 515-21 (1956) Apr.

9291
INVESTIGATION OF CORROSION RESISTANCE OF SOLID SOLUTIONS OF METALS. I. In–Pb SYSTEM. N. N. Gratsianskiĭ and M. L. Kaplan (Kiev Inst. of General and Inorganic Chemistry). Zhur. Fiz. Khim, 30, 651-9(1956) Mar. (In Russian).

Resistance to corrosion of In–Pb solid solution in 1% of H_2SO_4 at 16°C and in 1% of citric acid at 16 to 50°C was investigated. The rate of corrosion weight loss was measured and the potentials of corroding alloys were determined. A limit to corrosion resistance was observed in low melting solid solutions of In–Pb, the atoms of which possess a high diffusion velocity. This observation is in disagreement with Tamman's theory which considers the corrosion resistance limits only in the absence of atoms of high diffusion velocity. The resistance to corrosion in alloys of high content of In is due to the protective barrier formed by atoms of In. (tr-auth)

Refer also to abstract 9342.

GEOLOGY AND MINERALOGY

9292
A JOINT-FREE SAMPLE SPLITTER. Charles R. McKinney and Leon T. Silver (California Inst. of Tech., Pasadena). Am. Mineralogist 41, 521-3(1956) May-June.

A sample splitter based on the Jones riffle design has been devised. The splitter was folded from one piece of sheet metal and as such has neither cracks or joints to hold up material nor joining metal such as solder to contaminate the sample. (auth)

9293
USE OF STATISTICAL METHODS TO DETECT RADIOACTIVITY CHANGE DUE TO WEATHERING OF A GRANITE. W. L. Smith and F. J. Flanagan (U. S. Geological Survey,

Washington, D. C.). Am. J. Sci. 254, 316-24(1956) May.

Forty-four samples of the Conway granite were collected from the red and green phases of the rock at the Redstone, New Hampshire quarries. A large variation in radioactivity as measured by β-counting is shown between individual samples. Inspection of the data shows that the red phase is higher in radioactivity than the green. An analysis of variance with a single variable of classification shows that the means of the fresh and weathered red phases are not significantly different, whereas a "t" test using differences between pairs of the fresh and weathered green samples shows that the means of these two sets differ significantly. From these tests and a comparison of the variances of the respective sets, it is inferred that weathering has had a significant effect on the green phase only. It has been shown, by comparing the variances of the subsets of data with the known variance of the method of measurement, that some external factor such as variations in mineralogic composition or differential leaching or adsorption may be responsible for the variations in radioactivity. (auth)

9294

COMPARISON OF RADIOGENIC HELIUM AND LEAD IN ZIRCON. Patrick M. Hurley, Esper S. Larsen, Jr., and David Gottfried (Massachusetts Inst. of Tech., Cambridge and U. S. Geological Survey, Washington, D. C.). Geochim. et Cosmochim. Acta 9, 98-102(1956).

A direct comparison of He and radiogenic Pb in nonmetamict zircon crystals has indicated a 25% discrepancy between these radiogenic constituents. It appears that the amount of He is only three-quarters of the amount that should be present according to the content of radiogenic Pb. Approximately the same proportion was found in zircon having a wide range in age, activity, and total alpha irradiation, and in large pegmatite zircon crystals, as well as in microscopic crystals from igneous rocks. (auth)

9295

REPORT ON THE OCCURRENCE OF TECHNETIUM ON THE EARTH'S CRUST. G. E. Boyd and Q. V. Larson (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 60, 707-15 (1956) June.

A search for primordial Tc has failed to reveal any traces of this element in a variety of terrestrial substances, nor are recent reports of the occurrence of Tc in molybdenite and in yttrotantalite confirmed. Post-war nuclear chemical researches have shown that technetium possesses no beta stable nuclear species, although three long-lived isotopes have been established. Both Tc^{97} and Tc^{99} possess half-lives of less than one million years and hence, if initially present, would have disappeared in the approximately 4.5×10^9 years since the formation of the Earth. The possibility for discovering primordial technetium has therefore appeared to depend on whether or not the half-life of long-lived Tc^{98} exceeds 10^8 years. Results from chemical studies with gram quantities of fission product Tc^{99} suggest that technetium should exhibit a strong geochemical coherence with Re, which is known to be siderophile and chalcophile. Extremely senstivie methods for the detection of submicrogram quantities were developed. The most reliable method is that of isotopic dilution using Tc^{99} and mass spectrometric analysis. The neutron activation method based on the formation of 6.0 h Tc^{99m} from Tc^{98} although more sensitive, is subject to interference, particularly by the Tc^{99} (n,n') 6.0 h Tc^{99m} reaction. The negative result obtained in this search appears to be supported by a recent study which indicates a fairly positive disproof of the existence of technetium in the Sun, and by the preliminary finding in this Laboratory that the half-life of Tc^{98} is approximately 10^5 years. (auth)

9296

PRELIMINARY GEOLOGIC MAP OF THE CHALKY BUTTES AREA, SLOPE COUNTY, NORTH DAKOTA. COAL INVESTIGATIONS MAP C-38. G. W. Moore, R. E. Melin, and R. C. Kepferle. Washington, U. S. Geological Survey, 1956. $0.50.

9297

GEOLOGY OF THE ROC CREEK QUADRANGLE, COLORADO. GEOLOGIC QUADRANGLE MAP GQ-83. Eugene M. Shoemaker. Washington, U. S. Geological Survey, 1956.

9298

PHOTOGEOLOGIC MAP OF THE MOUNT PEALE-1 QUADRANGLE, SAN JUAN COUNTY, UTAH, AND MONTROSE COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-165. R. J. Hackman. Washington, U. S. Geological Survey, 1956. $0.50.

9299

PHOTOGEOLOGIC MAP OF THE EMERY-1 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-166. P. P. Orkild. Washington, U. S. Geological Survey, 1956. $0.50.

9300

RADIOMETRIC SURVEYS. Nuclear Eng. 1, 65-7(1956) May.

Aerial prospecting of deposits of radioactive ores has speeded up geological investigations. The information provided by the airborne equipment allows a contour map to be plotted of the received radiations, the resulting isorads giving a clear picture of the general radiation anomalies in the area surveyed. (auth)

9301

MEASUREMENT OF RADIOACTIVE AGES OF ROCKS. L. T. Aldrich (Carnegie Institution of Washington, D. C.). Science 123, 871-5(1956) May 18.

The several factors that provide opportunities for geologists and geochemists to examine the methods of radioactive age measurements are discussed. Among these factors are included new chemical methods, availability of separated isotopes and the extension of the range of sensitivity of mass spectrometers by several orders of magnitude. (J.E.D.)

METALS AND METALLURGY

9302 AD-75117

Pennsylvania State Univ., University Park.

RESEARCH AND DEVELOPMENT ON THEORETICAL AND EXPERIMENTAL STUDIES ON MECHANICS OF METAL FORMING. Final Report. Dept. of Engineering Mechanics. Owen Richmond, L. W. Hu, and Joseph Marin. Sept. 1, 1955. 80p. Contract DA-36-061-ORD-435.

Studies were conducted of the plastic deformation of a flat plate compressed between flat plates, the plastic indentation of a billet by a wedge, and the plastic indentation of a billet by a cone. The materials used in the experiments were annealed Cu, annealed Al, and cast Pb. Measurements were made of the total applied load, total deformation, pressure distribution on the die surface, and strain distribution within the deformed billet. Results were interpreted by a plasticity theory which neglects the elastic deformations and assumes no strain hardening. The theory was found suitable for the interpretation of large deformations. (auth)

9303 AECU-3285

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM THORIUM–MERCURY. Progress Report No. 1, [for] April 1, 1955–June 1, 1955. R. F. Domagala and W. Rostoker. June 13, 1955. 11p. Project No. B 076. For Oak Ridge National Lab. Contract W-7405-Eng-26, Subcontract No. 765. $3.30(ph OTS); $2.40(mf OTS).

Phase relationships in the Hg–Th system are to be determined. No alloys have as yet been prepared, although two approaches to this work are currently being pursued. In one method Th grindings will be introduced into a capsule of Hg, sealed, and "cooked." All steps including grinding are being conducted under vacuum or A. The second technique consists of passing Hg vapor over heated Th in a completely enclosed, recirculating system. By these alloying procedures it should be possible to determine phase relationships in this system by proceeding from each end of the diagram. Samples will be subjected to thermal and x-ray analysis to position the liquidus, solidus and any intermetallic compounds which exists. (auth)

9304 AECU-3286

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM THORIUM–MERCURY. Progress Report No. 2, [for] June 1, 1955–July 31, 1955. R. F. Domagala and W. Rostoker. Aug. 4, 1955. 15p. Project No. B 076. For Oak Ridge National Lab. Contract W-7405-Eng-26, Subcontract No. 765. $3.30(ph OTS); $2.40(mf OTS).

9305 AECU-3287

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM THORIUM–MERCURY. Progress Report No. 3, [for] August 1, 1955–September 30, 1955. R. F. Domagala and W. Rostoker. Oct. 19, 1955. 11p. Project No. B 076. For Oak Ridge National Lab. Contract W-7405-Eng-26, Subcontract No. 765. $3.30(ph OTS); $2.40 (mf OTS).

Mercury–thorium alloys containing from 0.7 to 72.9% Th were prepared by grinding Th chips into a bulb of Hg under a protective atmosphere. Thermal analysis of five of the alloys and pure Hg has shown a definite and reproducible use in the melting point of Hg with Th additions. A peritectic horizontal at –32°C has been tentatively set at the Hg-rich region of the diagram. Information to date substantiates $ThHg_3$ as being the first intermediate phase encountered in the system going from the Hg end. The Hg vapor-heated Th apparatus has been demonstrated to be of no value for preparing Th-rich alloys. (auth)

9306 AECU-3288

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM THORIUM–MERCURY. Progress Report No. 4, [for] October 1, 1955–November 30, 1955. R. F. Domagala and W. Rostoker. Dec. 19, 1955. 12p. Project No. B 076. For Oak Ridge National Lab. Contract W-7405-Eng-26, Subcontract No. 765. $3.30(ph OTS); $2.40(mf OTS).

Alloy specimens were prepared over the composition range 0.7 to 79.2% Th. A technique of dropping freshly cut chips into a pool of Hg under protective atmosphere conditions was selected as the best method of alloying. Transfers of these reactive alloys to X-ray capillary and other tubes were successfully accomplished in a "dry-box" constructed for this purpose. X-ray photograms have established the existence of a hexagonal intermediate phase with the parameters c = 4.911 Å and a = 3.367 Å. Resistivity experiments with Hg-rich alloys have shown a very sharp rise in the liquidus temperature with increasing amounts of Th. (auth)

9307 AECU-3289

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM THORIUM–MERCURY. Interim Summary Report No. 5 [for] April 1, 1955–February 29, 1956. R. F. Domagala and W. Rostoker. Mar. 8, 1956. 27p. Project No. B 076. For Oak Ridge National Lab. Contract W-7405-Eng-26, Subcontract No. 765. $4.80(ph OTS); $2.70(mf OTS).

A total of nineteen alloys was prepared by grinding Th chips into a pool of Hg contained in a Vycor bulb. This operation was conducted under a protective A atmosphere. The bulbs were sealed and given an anneal to promote the production of homogeneous alloys. These alloys were found to be reactive with air so that all operations requiring alloy transfers from their original container were conducted in a "dry box". Alloys up to 18.5% Th were subjected to thermal analysis and resistivity studies to position a peritectic reaction at –32°C and a very steeply rising liquidus in the Hg rich region of the system. X-ray and chemical analyses studies of as-prepared alloys as well as alloy specimens treated in "U" tube experiments provided for the identification of a hexagonal $ThHg_3$ phase and two face centered cubic phases, tentatively ThHg and Th_2Hg. While a complete diagram cannot be constructed at this time, only a limited number of possible forms can be drawn and these are shown. It was also demonstrated that removal of Hg from the alloys even at temperatures as high as 1000°C is not complete in short times and that very likely kinetics problems are involved in any discussion of the decomposition of phases in this system. (auth)

9308 AECU-3290

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE SYSTEM THORIUM–MERCURY. Progress Report No. 6 [for] March 1, 1956–April 30, 1956. R. F. Domagala and W. Rostoker. May 14, 1956. 10p. Project No. B 076. For Oak Ridge National Lab. Contract W-7405-Eng-26, Subcontract No. 765. $1.80(ph OTS); $1.80(mf OTS).

Phase relationships in the binary system Th–Hg are being studied. In addition, a study of the increase in Th content of Hg–Th products by distillation as a function of time, temperature and initial mercury content is being pursued. Four large samples of an alloy containing 25% Th have been prepared and will be used for the beneficiation work. Several alloys for phase relationship study have been made and additional compositions are currently being prepared. All alloys will be made by grinding Th chips into a pool of Hg in a Vycor tube under a protective A atmosphere and flame sealing the bulb in vacuo when the proper composition is reached. Experimental work to resolve the problem of ThO_2 patterns observed in X-ray films of certain alloys in earlier work is in progress. (auth)

9309 BMI-1111

Battelle Memorial Inst., Columbus, Ohio.

THE SOLID SOLUBILITY OF URANIUM IN THORIUM AND THE ALLOTROPIC TRANSFORMATION OF THORIUM–URANIUM ALLOYS. Wendell B. Wilson, Alfred E. Austin, and Charles M. Schwartz. July 12, 1956. 14p. Contract W-7405-eng-92. $3.30(ph OTS); $2.40(mf OTS).

High-temperature x-ray-diffraction studies were conducted with thorium–uranium alloys with up to 10 wt.% uranium. The solid solubility of uranium in thorium as a function of temperature was determined by the method of lattice parameters. Thorium will dissolve up to 2.5 wt.% uranium at 950°C, 4.5 wt.% at 1150°C, and 7.5 wt.% at 1250°C. Determinations were made of the temperature of the transition of thorium and of the effect of uranium upon the transition. The alpha-to-beta transition for thorium was observed to occur at 1330 ± 20°C. Mean coefficients of expansion were calculated for thorium and two alloys and for ThO_2 in contact with the thorium using x-ray lattice-parameter data. Values obtained at 950°C for thorium and ThO_2 were, respectively, 12.1 and 9.40 × 10^{-6} per C. Impurities obtained during the x-ray exposure

were identified by diffraction and were essentially ThO_2 and ThC, with two additional unknown phases being detected. The effect of the impurities upon the results is discussed. (auth)

9310 BMI-1112

Battelle Memorial Inst., Columbus, Ohio.

STUDY OF HYDRIDES. Max J. Trzeciak, Dale F. Dilthey, and Manley W. Mallett. July 12, 1956. 34p. Contract W-7405-eng-92. $0.30(OTS).

A study was conducted for the purpose of analyzing factors which influence the hydrogen capacity of metal hydrides. In the course of the investigation the pure metal hydrides $CrH_{1.6}$, $VH_{0.94}$, $NbH_{0.93}$, and $HfH_{2.16}$ were produced. Additions of various alloying elements to Ti and Zr were found to have significant effects upon the room-temperature H capacity of the hydrides. A systematic investigation of the effect of additions of various alloying elements on the thermal stability of zirconium hydride in the range 1000 to 2200°F was also made. (auth)

9311 COO-211

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

A STUDY OF THE MECHANISMS OF HEAT TREATMENT OF ZIRCONIUM-BASE ALLOYS. Summary Report No. 3 [for] July 1, 1955–June 30, 1956. July 17, 1956. 82p. Project B-068. Contract AT(11-1)-315. $12.30(ph OTS); $4.50(mf OTS).

This two year program was designed to provide a systematic and scientific approach to the realization of optimum properties in zirconium alloys through alloying and heat treatment. The results of the second year's efforts is presented to complement the data obtained in the first year's work. After establishing the time-temperature-transformation curves for Zr-1, 3, 5 and 7% Mo (eutectoid type) alloys, mechanical property data as a function of isothermal quench as well as quench-and-reheat heat treatments were established. The former technique was found to produce optimum properties in the 1% Mo composition. The 3, 5 and 7% Mo alloys exhibited a brittle behavior irrespective of heat treatment. The presence of a transition phase "omega" in the $\beta \rightarrow \alpha$ transformation was discovered which undoubtedly accounts for much of the brittleness observed. This phase was tentatively indexed as tetragonal, c/a = 1.45, a = 4.40 A. It forms in the $\beta \rightarrow \alpha$ transformation at temperatures below ~525°C. A study of hardness vs. composition for Zr binary alloys containing Nb, Cr, Mn, Th or V water quenched from the β field strongly suggests the presence of omega phase in several instances. Embrittlement would be anticipated. Time-temperature-transformation curves and hardness as a function of transformation were determined for alloys containing 7 and 15% Nb. The data collected are interpreted as proof of transition phase embrittlement. It is felt that a firm foundation has been laid for a definitive study of transition phase in zirconium eutectoid alloys. The Zr–Ti composition prototypes of α and β isomorphous alloys demonstrated a general lack of response to heat treatment. Significant improvements in impact strength and optimum conditions for other mechanical properties were developed by finish-forging the 5 and 15% Ti alloys in the $\alpha + \beta$ field. A correlation between hardness and tensile strength was observed. The peritectoid prototype alloys, Zr-4, 7.5 and 11% Sn, were subjected to several heat treatments designed to complete the picture for this last group of alloys. The 4% Sn composition showed promise as a potentially satisfactory weldable material although all three alloys showed little value as "heat-treatable" alloys. (auth)

9312 EES-060088F

Naval Engineering Experiment Station, Annapolis.

EVALUATION UNDER THERMAL SHOCK OF SMALL SIZE, WELDED BIMETALLIC PIPE JOINTS. W. E. Clautice. Mar. 12, 1956. 68p.

The results of the exposure of 10 bimetallic, welded pipe joints, of the type used in the newly developed nuclear power submarine propulsion plants, to repeated cycles of thermal shock are presented. The thermal cycle used was selected by a conference at the Bureau of Ships and was based on the expected service conditions for the Cres-Monel joints. Four joints were evaluated after the application of 250 thermal shock cycles. The remainder were subjected to 500 thermal shocks. All joints developed cracks under the test conditions. (auth)

9313 EMRL-2

Brown Univ., Providence. Engineering Materials Research Lab.

FATIGUE OF METALS UNDER COMBINATIONS OF STRESS. Cover carries title: THEORIES RELATING TO FATIGUE OF MATERIALS UNDER COMBINATION OF STRESS. Technical Report No. 2 on BASIC RESEARCH ON FATIGUE FAILURES UNDER COMBINED STRESS. W. N. Findley. June 1956. 17p. DA Project 5B99-01-004. Contract DA-15-020-ORD-3520.

Analysis of available information suggests that the phenomenon of fatigue of materials results primarily from alternating shearing stress producing cracks along shear planes, and that the resistance to fatigue cracking is influenced by other factors. Some of these factors are: changes in structure of the material resulting from plastic and elastic stressing as well as heat treatment; the mode of crack propagation and the complementary normal stress on planes of shear stress. Several theories of failure under combined stress are examined and modified to account for observed facts. A general design expression is proposed. The influence of mean stress (including extreme compression), yielding, complementary normal stress, and anisotropy are considered. (auth)

9314 EMRL-3

Brown Univ., Providence. Engineering Materials Research Lab.

FATIGUE OF METALS UNDER COMBINATIONS OF STRESSES. Technical Report No. 3 on BASIC RESEARCH ON FATIGUE FAILURES UNDER COMBINED STRESS. W. N. Findley. June 1956. 45p. DA Project 5B99-01-004. Contract DA-19-020-ORD-3520.

Analysis of available information suggests that the phenomenon of fatigue of materials results primarily from alternating shearing stress producing cracks along shear planes, and that the resistance to fatigue cracking is influenced by other factors. Some of these factors are: changes in structure of the material resulting from plastic and elastic stressing as well as heat treatment; the mode of crack propagation and the complementary normal stress on planes of shear stress. Several theories of failure under combined stress are examined and modified to account for observed facts. A general design expression is proposed. The influence of mean stress (including extreme compression), yielding, complementary normal stress, and anisotropy are considered. (auth)

9315 ER-7364

Martin (Glenn L.) Co., Baltimore.

PRELIMINARY INVESTIGATION OF ALFENOL–THERMENOL ALLOYS. J. N. Siltanen, E. A. Wooden, M. D. Moller, and C. F. Burrows. July 1955. 28p.

This preliminary investigation of Thermenol suggests that it could be developed for use in a number of aircraft and nuclear applications. Airframe usage would be

dependent on improvement in the room temperature ductility, high temperature properties, and the corrosion resistance of this alloy. These applications would also be dependent on the unresolved questions of impact resistance and fatigue. Pending the successful resolution of these problems Thermenol could then be used on a substitution basis for many applications where the temperatures are too high for Al alloys. It could also justifiably replace Ti since there would be a decided cost advantage and it could be used at temperatures where Ti is susceptible to interstitial contamination and embrittlement. Use of Thermenol would also generally result in a weight saving when replacing stainless steel, with the exception of the precipitation hardening types. It should strongly be considered for its non-strategic alloy content from a producibility point of view. It must be emphasized that many of these uses would be limited by the low room temperature ductility of Thermenol. (auth)

9316 KAPL-1533

Knolls Atomic Power Lab., Schenectady, N. Y.
INTERNAL PRESSURE STRESS-RUPTURE TESTS OF SMALL-DIAMETER TUBING. E. E. Baldwin. Apr. 10, 1956. 62p. Contract W-31-109-Eng-52. $0.40(OTS).

To simulate fission-gas pressure build-up in fuel elements, internal pressure stress-rupture tests were conducted on samples of 0.080-in.-diameter Type 347 stainless steel tubing of 0.010-in. wall thickness, using supercritical water as the pressure medium. The results of this investigation indicated that it was impossible to calculate the rupture life of a test specimen or to construct an internal pressure stress-rupture curve because of the inaccuracies of measurement and pressure calculations. The results also indicated that welding or brazing of end closures, and annealing, cold work, or carburization of the specimen wall had little effect upon the rupture life or manner of failure of the specimens. (auth)

9317 MR-606

Frankford Arsenal. Pitman-Dunn Labs., Philadelphia.
TRUE STRESS-TRUE STRAIN RELATIONSHIPS OF COMMERCIALLY PURE TITANIUM AND ZIRCONIUM IN COMPRESSION AND IN TENSION. W. B. Steward, Jr. Apr. 1955. 25p. Project TS1-11. (AD-66512).

The strain-hardening characteristics of commercially pure titanium and zirconium in compression and in tension produced a curvilinear logarithmic relationship over the range of plastic strains from 0.01 to 0.4. Longitudinal oriented specimens exhibited a greater degree of strain hardening in compression than in tension. Logarithmic plots of the true stress-natural strain data revealed that the work-hardening characteristics tested do not adhere to the straight line logarithmic relationship. (F.S.)

9318 NACA-RM-56B07

Alabama. Univ., Tuscaloosa.
ELEVATED-TEMPERATURE FATIGUE PROPERTIES OF TWO TITANIUM ALLOYS. William K. Rey. May 12, 1955. 28p.

The unnotched fatigue properties of two titanium alloys were evaluated at temperatures from room temperature to 1000°F. The results are presented in tabular form and as curves of stress versus cycles to failure for each test temperature. The decrease in endurance strength with an increase in temperature is shown by a curve of endurance strength versus temperature for each alloy. (auth)

9319 NACA-TN-3752

Langley Aeronautical Lab., Langley Field, Va.
TENSILE PROPERTIES OF AZ31A-0 MAGNESIUM-ALLOY SHEET UNDER RAPID-HEATING AND CONSTANT-TEMPERATURE CONDITIONS. Ivo M. Kurg. Aug. 1956. 21p.

Specimens of AZ31A-0 magnesium-alloy sheet were heated to rupture at nominal rates of 0.2 to 1000°F per second under constant tensile load conditions. The data are presented and compared with the results of conventional tensile stress-strain tests at elevated temperatures after ½-hr exposure. A temperature-rate parameter was used to construct master curves from which stresses and temperatures for yield and rupture can be predicted under rapid-heating conditions. A comparison of the elevated-temperature tensile properties of AX31A-0 and HK31XA-H24 magnesium-alloy sheet under both constant-temperature and rapid-heating conditions is included. (auth)

9320 NP-5955

California. Univ., Berkeley. Minerals Research Lab.
ACTIVATION ENERGIES FOR CREEP OF HIGH PURITY ALUMINUM. O. D. Sherby, J. L. Lytton, and J. E. Dorn. Apr. 15, 1956. 26p. Contract N7-onr 295, Task Order II, Technical Report No. 46.

Activation energies for creep of high-purity Al were obtained over the temperature range from 77°K to 880°K by rapidly changing the temperature during creep at constant stress. The experimentally obtained activation energy was shown to be insensitive to stress and strain, and this fact questions the validity of those theories for creep that postulate stress and strain dependent activation energies. From 500°K to 880°K the activation energy for creep was found to be independent of temperature and equal to 35,500 calories per mole which is the same as that for self-diffusion of Al. Between 0.25 and 0.40 T_m (250 to 375°K) the activation energy for creep was found to be equal to about 27,500 calories per mole. Below 0.25 T_m the activation energy for creep was found to decrease rapidly with decreasing temperature; it was shown that the presence of at least four discrete activation energies could account for these low temperature results. (auth)

9321 NP-5962

New York Naval Shipyard. Material Lab., Brooklyn.
DYNAMIC PROPERTIES OF DUCTILE CAST IRON. Final Report. I. A. Schwartz. Sept. 16, 1955. 36p. Lab. Project 5435.

In a study of the Charpy impact properties of ductile cast iron (V-notched and un-notched) for comparison with those of class "B" cast steel, the notched ductile irons have a transition temperature range which compares substantially with class "B" except that steel shows a higher energy absorption over the same range. The transition temperature ranges and transition temperatures are lower for unnotched than for V-notched samples. (F.S.)

9322 NP-5963

California. Univ., Berkeley. Minerals Research Lab.
PREPARATION, IDENTIFICATION, AND CHEMICAL PROPERTIES OF THE NIOBIUM GERMANIDES. John H. Carpenter and Alan W. Searcy. July 1955. 18p. Contract Nonr-222(32), Technical Report No. 1.

An x-ray-diffraction investigation establishes the existence of the compounds Nb_3Ge_2 (or Nb_5Ge_3), Nb_2Ge, and Nb_3Ge in addition to $NbGe_2$, which had previously been reported. A ternary compound is formed in which carbon apparently substitutes for niobium in the Nb_2Ge lattice. The decomposition temperature of $NbGe_2$ is 1483 ± 15°C. The Nb_3Ge compound is stable at least to 1650°C and Nb_2Ge and Nb_3Ge are stable at least to 1910 ± 15°C. Nb_3Ge has the β-tungsten structure, with a = 5.168 ± 0.002 A. The hexagonal structure of $NbGe_2$ is confirmed. Cell constants of a = 4.966 ± 0.003 A and c = 6.781 ± 0.003 A are found. Reactivities of the niobium germanides with some common chemicals are reported. (auth)

9323 NRL-4730

Naval Research Lab., Washington, D. C.
INVESTIGATION OF METALLURGICAL AND MECHANI-

CAL EFFECTS IN THE DEVELOPMENT OF HOT TEARING. H. F. Bishop, C. G. Ackerlind, and W. S. Pellini. Mar. 28, 1956. 19p. Project No. NR-642-030.

The various types of hot-tearing or hot-cracking defects developed in metal processing operations, such as casting and welding, occur at temperatures associated with the presence of liquid films. These defects represent a separation of the metal through liquid film paths, produced by strains resulting from nonuniform heating or cooling. All alloys may be made to hot tear if sufficiently high strains are imposed during the period of the liquid film stage. The sensitivity of various alloys to the presence of low-melting segregates which extend film life depends on the strain level imposed on the film regions and, therefore, on the mechanical conditions of the system—casting, weldment, or forging. The contraction characteristics of metals in subsolidus temperature ranges is an important factor in the development of either adverse or beneficial mechanical conditions with respect to hot tearing. Information provided for the case of casting systems may be translated, in principle, to welding, brazing, and other types of systems. (auth)

9324 NRL-4731

Naval Research Lab., Washington, D. C.

INVESTIGATION OF MODIFIED 12% CHROMIUM STEELS FOR INTERMEDIATE TEMPERATURE APPLICATIONS. Paul Shahinian and Joseph R. Lane. Mar. 30, 1956. 25p.

An investigation was made of the creep-rupture properties of 12% Cr steels modified by additions of Mo, Cr, Nb, Ti, and C. Tests were conducted at 1100° and 1200°F for materials in various conditions, including: as cast; cast and homogenized; forged and normalized; and forged, normalized, and tempered. The room-temperature tensile properties of the alloys were also determined. A limited study of the effect of heat treatment on creep-rupture properties indicated that rupture life was increased by raising the austenitizing temperature, and also increased to a small extent by faster cooling rates. The high-temperature strength of a base composition (11.5% Cr, 0.16% C, 0.5% Mo, 0.7% V) was improved by an increase in Mo and lowered by increases in C, V, and Ti; Nb did not produce a consistent effect. The forged alloys in the normalized condition were stronger than in the normalized and tempered condition, but inferior to the cast and homogenized alloys. One of the modifications, containing 1.0% Mo and 0.7% V, possesses creep-rupture properties which compare favorably with those of the best Nb-free alloys developed thus far. (auth)

9325 ORNL-1990

New England Materials Lab., Inc., Medford, Mass.

FINAL REPORT ON DEVELOPMENT AND TESTING OF NICKEL—MOLBYDENUM ALLOYS. F. C. Monkman, Jr., N. J. Grant, and C. F. Floe. Nov. 28, 1955. 45p. [For] Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 584. $0.35(OTS).

Effects of vacuum melting and variations in composition on the ductility, mechanical and stress-rupture properties of Ni—Mo alloys are determined. (auth)

9326 RAE-TN-MET-218

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

IMPURITIES IN TITANIUM: SULPHUR. D. A. Sutcliffe. Mar. 1955. 14p. (AD-72124).

Binary titanium—sulfur alloys containing up to 1.05% sulfur have been prepared by arc melting. Tensile, hardness, and impact tests have been made on the alloys at room temperature. The results show that the addition of approximately 0.1% S causes a marked rise in tensile strength and hardness with a corresponding fall in elongation and impact strength. Further additions up to 1.05% S cause only a small increase in tensile strength and hardness, but the elongation and impact strength continue to decrease steadily, though less rapidly than at first. (auth)

9327 TAM-89

Illinois. Univ., Urbana.

AN INVESTIGATION OF THE BEHAVIOR OF MATERIALS UNDER REPEATED STRESS. Final Report. (Technical Report No. 47). T. J. Dolan. June 1955. 34p. Project NR-031-005. Contract N6-ori-071(04). (AD-66671).

Attempts were made to evaluate the factors that must be considered in formulating a satisfactory explanation of the structural action and strength characteristics of machine members in repeated stress service. Information was obtained on the effects of the following factors on the behavior of materials subjected to repeated stressing: (1) various ranges of stress for several given states of stress; (2) the influence of specimen shape and size; (3) the variation in fatigue life caused by fluctuating loads that produced a varying amplitude of repeated stress; (4) the influence of metallurgical structure on fatigue strength and notch sensitivity; (5) strain hardening and residual stresses resulting from prior plastic deformation; (6) the fundamental statistical nature of fatigue data and their appropriate interpretation; (7) basic concepts of fatigue damage in metals; (8) the influence of strain aging and changes in the inherent characteristics of the metal while being repeatedly stressed. Abstracts are presented for 46 technical reports which contribute additional information on the nature of fatigue damage. (ASTIA abst.)

9328 TID-8013

Technical Information Service, AEC.

DEVELOPMENTS IN STAINLESS STEEL WELDING IN THE NUCLEAR PROGRAM. E. B. LaVelle, Hanford Atomic Products Operation, L. H. Rasmussen, and E. M. Kuchera, J. A. Jones Construction Co. [nd]. 21p. $0.20(OTS).

One of Its monograph series "The Industrial Atom."

An improved method for fabrication by welding and the new technique for joining austenitic stainless steel weld joints at the closure pass are described. (R.V.J.)

9329 WADC-TR-52-251(Pt. 4)

Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION OF COMPRESSIVE-CREEP PROPERTIES OF ALUMINUM COLUMNS AT ELEVATED TEMPERATURES. Work Period Covered: December 1, 1954 to December 1, 1955. R. L. Carlson, E. G. Bodine, and G. K. Manning. Apr. 1956. 79p. Project Title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task Title: DESIGN AND EVALUATION DATA FOR STRUCTURAL METALS. Contract AF-33(038)-9542.

A summary and an analysis of the results of an experimental study of the creep buckling of columns is presented. The results include investigations of the behavior of short, inelastic columns of the Al alloy 2024-T4, of square tubing columns of Al alloy 2024-T3, and columns of the stainless steel 17-7PH (THD 1050). Data from all phases of the investigation indicate that column imperfection variations can cause marked scatter in lifetime. It is concluded that the effect of imperfection variations will exert a strong influence on the evolution of practical methods of designing for creep buckling. Shanley's time-dependent tangent modulus is applied to the test data, and it is found to be fairly successful in providing an estimate of the possible loss in load capacity with time. It is observed that the agreement with test data can be expected to vary significantly with column imperfection. The possible existence of a lower load limit below which collapse will never occur is discussed. From

a consideration of known creep behavior, it is concluded that there may be a temperature below which finite lower limits do exist and above which the lower limit is zero. (auth)

9330 WADC-TR-53-336(Pt. 5)

California. Univ., Berkeley. Inst. of Engineering Research.

THE CREEP PROPERTIES OF METALS UNDER INTERMITTENT STRESSING AND HEATING CONDITIONS. PART 5. FURTHER CREEP RESULTS ON AlCLAD 7075-T6 ALUMINUM ALLOY AND CONSIDERATION OF ANALYTICAL PROCEDURES. Work Period [from] October 1954 to October 1955. N. H. G. Daniels and H. B. Masuda. May 1956. 96p. Project Title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task Title: DESIGN DATA FOR METALS. Contract AF-33(038)-11502.

A further study of the creep properties of Al alloy Alclad 7075-T6 (Clad 75S-T6) under isothermal intermittent stressing and under cyclic temperature steady load conditions was made at 300, 450 and 600°F. For the intermittent stressing conditions, cycles in which the load was on for 5 min out of a 2 hr cycle, 5 min out of a 12-min. cycle, and 24 hr out of a 48 hr cycle were used. The first cycle was shown to have seriously deleterious effects, particularly at 300°F, where the net times under load to reach specified strains or fracture were reduced to approximately one eighth of the corresponding times for steady load isothermal creep. At 300°F it was shown that the ratio of on-load time to off-load time controlled the scale of the effect of the intermittent condition, which was apparently independent of the total duration of each cycle. Empirical methods of analysis and prediction based on the equation used in previous work were successfully applied to the results both at 300 and 450°F. Neither the above correlation method nor the use of comparisons based on net time under load were successful at 600°F for the extreme types of cycle used. Correlations for other alloys are also given. The cyclic temperature, steady load creep data were also subjected to attempted analysis using other correlation methods available in the literature, but these did not seem superior to the above empirical method. Other intermittent condition creep data were also analyzed, and the limitations of the method, were confirmed. (auth)

9331 WADC-TR-54-17(Pt.2)

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

JOINING OF MOLYBDENUM. [Period covered] September 1953 to September 1954. W. N. Platte. Nov. 1955. 130p. Project No. 1252. Contract AF18(600)-114.

A study of the factors which influence the physical properties, especially the ductility, of Mo welds is discussed. Welds in both arc-cast and vacuum-sintered Mo made in commercially pure inert atmospheres and in contaminated inert atmospheres were examined. The effects of several deoxidizers on the welding properties of vacuum-sintered Mo are examined. The specific requirements of deoxidizing agents are established and it is shown that Ti between 0.2 and 0.5% meets these requirements. The effects of interstitial elements, O_2, N_2, and C, on the weld properties of arc-cast Mo were examined. It is shown that the limits for O_2 in the inert gas welding atmosphere can be predicted. The deleterious effects of N_2 and O_2 are shown quantitatively by means of bend test data. Both O_2 and N_2 reduce the ductility of Mo weld metal. Carbon is also believed to have a similar effect. Oxygen and N_2 are shown to have an interaction effect when used in combination in the inert welding atmosphere. Nitrogen reduces the deleterious effects of O_2 and vice versa, but the combination is not as effective as high-purity inert gas as a welding atmosphere. Exploratory studies are described for slightly improved inert gas atmospheres and post-weld heat treatment. Butt welds were made to establish the validity of using "bead on plate welds" as a test criterion. (auth)

9332 WADC-TR-54-54

Michigan. Univ., Ann Arbor. Engineering Research Inst.

A STUDY OF CREEP OF TITANIUM AND TWO OF ITS ALLOYS. Jeremy V. Gluck and James W. Freeman. Mar. 1956. 191p. Task title: METALLIC MATERIALS. Task title: MECHANICAL BEHAVIOR OF METAL. Contract AF33(038)-14111.

Metallurgical factors influencing the creep of commercially pure titanium, a 7% Mn alloy and a Cr–Fe alloy in the form of sheet were studied at 76, 210, 400 and 600°F. Rapid and extensive creep was found at stresses only a fraction of the yield strength at all temperatures. Annealing the commercially pure Ti at temperatures below the temperature of transformation to beta reduced the creep resistance. Heat treatment from the beta range increased creep resistance. Cold work increased creep resistance. In the alloys, increasing amounts of beta phase obtained by treatment at increasingly higher temperatures in the alpha and beta phase regions and rapidly cooling increased the creep resistance of the alloys. Treatment of the alloys at high temperatures in the alpha and beta range or in the beta range resulted in brittleness. Creep resistance fell off with increasing temperature but there was a reversal in the deterioration with a maximum at about 400°F. Strain aging and/or beta instability in this temperature range is responsible for the reversal. Increased strengths from increased amounts of beta appeared to be largely due to strengthening from breakdown of beta to highly strained transition structures during testing at all temperatures covered by the investigation. (auth)

9333 WADC-TR-54-278(Pt. 3)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF TITANIUM-BASE ALLOYS FOR ELEVATED TEMPERATURE APPLICATION. Period of Work: January 7, to December 31, 1955. William F. Carew, Frank A. Crossley, and Donald J. McPherson. May 1956. 100p. Project Title: METALLIC MATERIALS. Task Title: TITANIUM METAL AND ALLOYS. Contract AF-33(616)-2853.

Effects on mechanical properties of complexing the α and β phases of a promising α-β type alloy, Ti–6Al–3Mo were studied. Tin and Zr were employed as α complexers and Cr, Mn, and V were employed as β complexers. α complexing was found to improve creep resistance and rupture strength, while β complexing reduced these parameters below the leves of the base composition. In addition, age hardening characteristics of Ti–Al–Ag alloys were determined. Limited creep-rupture data indicated inferiority to a Ti–6Al binary composition. Further studies on the nature of embrittlement in binary Ti–Al alloys were carried out and results of these studies are reported. (auth)

9334 WADC-TR-54-343

Kentucky. Univ., Lexington. Kentucky Research Foundation.

PREFERRED ORIENTATION AND DEFORMATION IN TITANIUM AND TITANIUM ALLOYS. [Summary Report for] February 1951 through August 1954. Carl J. McHargue, Cullie J. Sparks, Jr., and Joseph P. Hammond. Dec. 1954. 114p. Project title: METALLIC MATERIALS. Task title: THE EFFECT OF COMPOSITION AND INTERNAL STRUCTURE ON THE PROPERTIES OF

ALLOYS. Contract AF33(038)-19574. (AD-68001).

Preferred orientations in titanium and titanium alloys containing aluminum, columbium, tantalum, molybdenum, and zirconium in solid solution were produced by cold rolling, annealing and hot rolling. The effect of cycling through the alpha-beta transformation on the texture of cold-rolled titanium was determined. Preferred orientations in titanium were varied by changing the amount of reduction in cross-sectional area. All resulting textures were determined by x-ray methods, evaluated and compared with previously determined textures of titanium and other metals and alloys. Texture layer effect as influenced by varying reduction was related to bendability. Alloying and low temperatures of hot rolling and annealing produced no major change from the cold-rolled texture of titanium. Higher temperatures of hot rolling and annealing (above 1300°F) produced textures differing from the cold-rolled textures by 30° rotations about the C-axis. Large crystals of titanium were produced and then deformed in tension at 1500°F and others of 4% Al–Ti, 10% Ta–Ti and 15% Zr–Ti deformed at room temperature were examined for deformation mechanisms. Slip occurred generally on the $(10\bar{1}0)$, $(10\bar{1}1)$ and (0001) planes and twinning on the $(10\bar{1}2)$, $(\bar{1}121)$ and (1122). (auth)

9335 WADC-TR-54-462

Wright Air Development Center. Materials Lab., Wright-Patterson, AFB, Ohio.

AN ANALYSIS OF NOTCHED UNIAXIAL FATIGUE DATA. [Period covered] March 1, 1953 to April 1, 1954. William E. Dirkes. Mar. 1955. 31p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. (AD-67336).

An analysis of the failure trends of fatigue data is presented in terms of the nominal applied stresses. Fatigue failure stresses are related to the maximum tensile stresses applied to test specimens. The concepts presented are used as a means of expressing notched specimen characteristics. Test data for 2014-T6(14S-T6) and 2024-T4(24S-T4) aluminum alloys and SAE 4130 steel were taken from WADC TR 52-307 and NACA TN 2639 for use in this analysis. The test data available are in agreement with the concepts presented; however, additional data are required to prove the analysis. Data for failure of unnotched specimens by a semi-graphical method. Fatigue strengths for notched specimens can be predicted for various mean strengths from tensile test data, fatigue data for unnotched specimens, and a single SN curve for notched specimens. The method as presented is limited to ductile materials tested with axially applied loads and is applicable for fatigue strengths determined for large numbers of cycles. (auth)

9336 WADC-TR-54-547

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

EVALUATION OF HIGH STRENGTH WELDABLE TITANIUM-BASE ALLOYS. [Period covered] January 1954 through November 1954. C. Robert Lillie. Dec. 1955. 61p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2321.

Six Al–Ti–V compositions were investigated to determine their suitability as high strength weldable sheet to be used at elevated temperature. Tensile tests were performed, after suitable heat treatment, both at room temperature and at 700° and 900°F, and in both welded and unwelded conditions. Bend tests were employed as a measure of the formability of the material. All bend tests were carried out at room temperature on heat treated material in both welded and unwelded conditions. Metallographic structure of the alloys after various heat treatments was correlated with the mechanical properties. All of the alloys were found to provide easily rollable sheet material capable of being heat treated to a strength level competitive with stainless steel at elevated temperatures, on a strength-weight basis. The alloys were weldable, producing ductile welds which required no post-welding heat treatment. By proper heat treatment, a low ratio of yield strength to ultimate strength was obtained, indicative of good formability; subsequent aging raised the strength to a high level. Good properties were retained in these alloys when prepared of commercial quality sponge and when subjected to commercial heat treatments. (auth)

9337 WADC-TR-55-71

Chicago. Univ. Inst. for the Study of Metals.

OPTICAL PROPERTIES OF METALS. L[eroy] G. Schulz. Mar. 1956. 45p. Project 7351, Task 70320: SURFACE REACTION IN METALS. Contracts AF33(038)-6534 and AF33(616)-2090.

The optical properties of Ag, Au, and Cu were studied experimentally and the results compared with those predicted by the Drude free electron theory. It was found that beyond about two microns the experimental results are in good agreement with the Drude theory. To bring about this agreement it was necessary to use the effective mass of the electrons in a metal as an adjustable parameter. Comparison of the results of reflection and transmission experiments suggested the existence of special surface properties of metals. (auth)

9338 WADC-TR-55-352

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STRUCTURAL CHANGES IN COMMERCIAL TITANIUM AND TITANIUM-BASE ALLOYS ON HEAT TREATMENT. Sheldon A. Spachner, Robert F. Domagala, Adolph W. Goldenstein, and William Rostoker. Feb. 1956. 95p. Project title: METALLIC MATERIALS. Task title: DEFORMATION MECHANISMS OF METALS. Contract AF33(616)-2559.

Research on three separate topics in the physical metallurgy of Ti alloys is summarized. A detailed study was made of the kinetics of aging of two prototype binary Ti alloys over the range of beta instability. TTT curves for an 8Cr and a 13Mo alloy in the temperature range 250 to 750°C and on a time scale of 0.1 to 10,000 min. were constructed. The areas of occurrence of transition phases are defined. Tentative analyses of the crystal structure of the omega transition phase are presented. In the 8Cr alloy, evidence is cited for the existence of a second transition effect. Studies on the very early stages of precipitation have yielded some unusual conclusions about the precipitate-matrix orientation relationships. Appendices describe new methods of orienting single crystals and an analyses of diffraction effects in reciprocal space which is not readily available in the literature. Experiments were conducted on a 4Cr–2Mo alloy with a view to separating out the singular effects of alpha platelet size and original beta grain size on the mechanical properties of transformed structures. The alpha platelet size was shown to exhibit a marked effect on all tensile properties. Original beta grain size was shown to influence tensile ductility appreciably, tensile strengths and impact strengths negligibly. A metallographic analysis of the mechanism of tempering of alpha prime in an 8Cr and a 13Mo alloy disclosed in the Mo alloy the α' needles generally temper by precipitating small particles of α, while in the Cr alloy tempering by diffusion across the α'/β interface is more common. (auth)

9339 WAL-401/259

Watertown Arsenal Labs., Mass.

EFFECT OF VACUUM ANNEALING ON THE IMPACT

PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. Eric B. Kula and Frank R. Larson. Apr. 19, 1956. 23p. Project title: METALS FOR LIGHTWEIGHT CONSTRUCTION.

Specimens from eleven heats of various Ti-base alloys, including five alpha and six beta compositions, were tested in impact over a range of testing temperature from −196° to +400°C, in both the mill-annealed and vacuum-annealed conditions. This work supplements an earlier effort which dealt with true stress-true strain properties of Ti alloys, together with their chemical compositions and microstructures. (auth)

9340 YE55-641

Sylvania Electric Products Inc. Metallurgical Labs., Bayside, N. Y.

UNIFORM ELONGATION OF TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report No. 4 [for] December 1, 1954−March 1, 1955. A. J. Opinsky, L. A. Sama, and L. L. Seigle. May 9, 1955. 18p. Contract AF33 (616)-2352. (AD-66864).

Investigations of the anisotropy of the limit of uniform elongation in commercial purity Ti, annealed four hours at 830°C, indicate a maximum elongation to maximum load in the direction of straight rolling. The cross-rolled samples studied show no improvement in the elongation to maximum load over the straight-rolled. A 600°C straight-rolled Ti−6 Al−4V alloy annealed 24 hours at 700°C has maximum elongation to maximum load in the rolling and cross directions. Several specimens of a 1.8% Cu alloy which might be age-hardenable had about 17 to 18% elongation to maximum load at room temperature, showing no improvement ever unalloyed Ti. (auth)

9341 AEC-tr-2410

III. THE OXIDATION MECHANISM OF METALS AND ALLOYS. Oswald Kubaschewski. Translated from Z. Metallkunde, 39, 218-20(1948). 6p.

Oxidation studies are presented for Al−Mg, W−Ni, and Mo−Ni alloys, Co, and Al at elevated temperatures. (W.L.H.)

9342 AEC-tr-2425

THE THEORETICAL AND EXPERIMENTAL BASIS FOR THE ELECTROMAGNETIC SORTING OF STEEL PARTS. IV. THE RESIDUAL FIELD METHOD. F. Förster. Translated from Z. Metallkunde 45, 233-8(1954). 9p.

A steady field sorting method which may be made fully automatic for most industrial uses was considered. This method differs from the electromagnetic in that the entire cross section of the sample enters into the test results in the same way, and not only a more or less deep surface layer as the case of alternating field methods. This method is particularly useful to such sorting problems in which it is important to investigate the inner characteristics (core strength, alloy mix-up, separation of depth-hardened pins, etc.). The constant field method is not suitable for sorting according to weak spots, boundary carbonization, photoelectric failure which are known to begin at the surface, since the volume of the surface layer in which the property under question varies is too small a fraction of the total sample volume. (auth)

9343 AERE-Lib/Trans-638

SURFACE TENSION OF BINARY METALLIC ALLOYS OF BODY-CENTERED AND FACE-CENTERED STRUCTURE. A. E. Glauberman and A. M. Muzychuk. Translated from Zhur. Fiz. Khim. 28, 1615-22(1954). 11p.

The theory of the surface tension of binary alloys based on the idea of the quasihetero-polarity of the alloy lattices was used to calculate the surface tension of binary intermetallic alloys of body-centered and face-centered structure. The surface tension of the alloys is expressed in terms of the "effective charges" characterizing the alloy components. (auth)

9344 NACA-TM-1395

THE FATIGUE STRENGTH OF RIVETED JOINTS AND LUGS. (De Vermoeiingssterkte van Klinkverbindingen en Pengatverbindingen). J. Schijve. Translated by J. Vanier from Nationaal Luchtvaartlaboratorium, Rapport M. 1952, May 1954. 54p.

Tests on riveted joints and lugs for the primary purpose of comparing the several types of riveted joints and the effect of various factors on the fatigue strength of lugs are reported. The application of single pulsating tension loads presented no difficulty. At the NLL some series of experiments of riveted joints and lugs have been performed. However, these do not completely cover the important part of the fatigue diagram and more experiments are recommended. A short discussion is given on the stress concentration factor K_t and three fatigue strength reduction factors, K_f, defined in different ways. The relation between K_f and K_t is considered. The various factors which might influence the fatigue strength of riveted joints are reviewed. For lugs the most interesting experiments and the methods to improve the fatigue strength are discussed. (auth)

9345

THE GROWTH OF WHISKERS BY THE REDUCTION OF METAL SALTS. Sidney S. Brenner (General Electric Research Lab., Schenectady, N. Y.). Acta Met. 4, 62-74 (1956) Jan.

The conditions for the growth of Fe, Cu, Ag, Ni, Co, Pt, and Au whiskers by the reduction of their halides are described. It is shown, at least in the case of copper, that the whiskers grow from the tip, and there seems little doubt that the growth occurs by the condensation of freshly-formed metal vapor. The supersaturation of the metal vapor appears to be extremely high during the whisker growth. Whiskers with a large variety of shapes and perfection grow under these conditions. Of greatest interest are the near-perfect whiskers which exhibit high strength and are bound by smooth planes. Whiskers larger than 8 μ are rarely near-perfect. (auth)

9346

VARIATION OF ANODIC FILM GROWTH WITH GRAIN ORIENTATION IN ZIRCONIUM. R. D. Misch and E. S. Fisher (Argonne National Lab., Lemont, Ill.). Acta Met. 4, 222-3(1956) Mar.

9347

ABRASIVE WEAR RESISTANCE OF METALS AND MINERALS, INCLUDING VERY HARD ONES. M. M. Khrushchov and M. A. Babichev. (Inst. for the Study of Machines). Doklady Akad. Nauk S.S.S.R. 107, 75-8(1956) Mar. 1. (In Russian)

Tests were made with technically pure metals and minerals to determine their wear resistance in friction contact with abrasive surfaces. Metal samples of Co, Cr, Ti, Mo, Be, W, Ge, Si, and WC and W_2C were tested as well as the minerals of gypsum, calcite, fluorite, quartz, topaz, rubin, nephrite, bazalt, and microlite. The methods of the test procedures are described and tabulations are given. (R.V.J.)

9348

SURFACE TENSION OF ALUMINUM AND ITS ALLOYS. A. M. Korol'kov (Baĭkov Inst. of Metallurgy). Izvest. Akad. Nauk S. S. S. R. Otdel. Tekh. Nauk No. 2, 35-42(1956) Feb. (In Russian)

The value of pure Al surface tension was established as 860 ± 20 dyne/cm. It was found that surface-active admixtures (Li, Ca, Mg, Sb, Sn, Pb, and Bi) sharply reduce the surface tension of aluminum. Moreover, the larger the difference between the atomic volume of added metal and the Al solution, the more reduced is the degree of tension. The

most pronounced reducing effect on the surface tension was caused by the components which combine with Al to form different phases. In foundry technology in using liquid metals as heat conductors, and in powder metallurgy the surface tension property is as important as viscosity and density. Data for surface tension (dyne/cm) for Al, Cu, Ag, Au, Mg, Zn, and Hg were obtained from calculations based on atomic parameters of solid metals. Investigations were made to establish the relation of the surface tension (dyne/cm) to the components of alloys (Al–Sn, Al–Pb, Al–Bi, Al–Si, Al–Mg, Al–Ca, Al–Sb, and Al–Li). (R.V.J.)

9349

NEW MATERIAL "GLIFTAMAL" FOR TESTING STRESS OF FLAT MODELS BY USING POLARIZATION-OPTICAL METHOD. M. F. Bokshteĭn, N. I. Prigorovskiĭ, S. I. Sokolov, and N. A. Shchegolevskaya. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 2, 139-41(1956) Feb. (In Russian)

A new type material "gliftamal" was developed for testing flat models at room temperature with reduced polymerization. "Gliftamal" is the product of pentaerythrite, glycerin, and diethylene glycol condensation with maleic and phthalein anhydrides. The material has a solidification time of 2 months. Disk-shaped samples were tested in polariscopes under diameter compression. The relations of m layers to the stresses and to the length of time render stress were determined. Selected samples showed optic proportionality of 30 bands calculated for 7 mm thickness. Tabular results are given. (R.V.J.)

9350

SOME DATA ON THE EQUILIBRIUM DIAGRAM FOR THE CHROMIUM-NIOBIUM SYSTEM. V. P. Elyutin and V. F. Funke. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 3, 68-76(1956) Mar. (In Russian)

Studies to determine the Cr–Nb equilibrium diagram were made using hydrogen-reduced electrolytic Cr of 99.89% Cr; 0.1% Fe; and 0.04% Si; baked in vacuum Nb moldings of 99.5% Nb; 0.06% Fe; 0.23% Ti; and 0.01% C, which were similar to Nb powder were used. Liquidus and solidus lines were constructed for Cr–Nb alloy equilibrium diagram. The presence of the metallic component Cr_2Nb and two eutectic conversions at 1600° and 1660° temperatures were established. The eutectic points were found for the alloys containing 21 to 22 and 39 at. % Nb. The existence of single phase hard solutions and their boundaries were revealed. The solubility of Nb in Cr was determined as 10 to 11 at. % at 1600°; 4.25 at. % at 1500°; and, 3.7 at. % at 1400°. Maximum solubility of Cr in Nb was 20 at. % at 1600° and 12 to 13 at. % at 1500°. (R.V.J.)

9351

GOOD CONTROL MAKES TITANIUM WELDING A SHOP TOOL. F. D. Seaman (Westinghouse Electric Corp., Kansas City, Mo.). Iron Age 177, No. 22, 64-6(1956) May 31.

Titanium weld-fabrication presents difficulties in mass production but ductile titanium joints with high yield strengths are possible. Inert gas tungsten electrode arc welding continues as the best and most practical current technique for joining titanium. Flash welding can be readily accomplished under controlled conditions. Resistance welding is possible but the metal is notch-sensitive and shows poor tensile and fatigue properties. (F.S.)

9352

LOW CARBON, LOW NITROGEN IMPROVE STAINLESS PROPERTIES. F. C. Monkman (Walworth Co., Boston) and N. J. Grant (Massachusetts Inst. of Tech., Cambridge). Iron Age 177, No. 22, 67-70(1956) May 31.

The rupture strength, creep resistance, and ductility of two-carbon and nitrogen stainless steels were superior to other vacuum-melted alloys with higher C and N content. The ductility of the vacuum-melted alloys was found to be independent of the rupture life and from two to four times that of similar stainless steels which had been air melted. (F.S.)

9353

THE PREPARATION OF ACID-STABILIZED SUBHALIDES FROM MOLTEN METAL–METAL HALIDE SOLUTIONS. John D. Corbett and Richard K. McMullan (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 2906-7(1956) June 20.

The addition of $AlCl_3$ to Bi–$BiCl_3$, Cd–$CdCl_2$, and Ga–$GaCl_3$ systems (liquid) resulted in the formation of the respective subhalides, BiCl, CdCl, and GaCl. The subhalides are diamagnetic and exhibited unique powder pattern lines. (C.W.H.)

9354

A THEORY OF THE YIELD POINT AND THE TRANSITION TEMPERATURE OF MILD STEEL. F. Forscher (Westinghouse Electric Corp., Pittsburgh). J. Appl. Mechanics 23, 219-24(1956) June.

Experimental results indicate the dependence of the yield-point phenomenon of mild steel on temperature, strain rate, duration of stress, and stress state. This paper proposes a yield criterion which can account for these variables. The theory is developed on the basis of a "structural" model, by which the behavior of microscopic and submicroscopic elements is idealized. The theory postulates as yield criterion a critical number of relaxation centers (active Frank-Read sources) or, equivalently, a critical size of relaxation centers. The transition-temperature phenomenon is considered to be the result of an inhibition of yielding (upper yield point) by means of geometry, temperature and/or strain rate. A relation is given which expresses its dependence on the state of stress and strain rate. (auth)

9355

THE CONSTITUTION OF THE TITANIUM–TIN SYSTEM IN THE REGION 0-25 ATOMIC PERCENT TIN. M. K. McQuillan (Imperial Chemical Industries, Ltd., Birmingham, England). J. Inst. Metals 84, 307-12(1956) Apr.

Micrographic examination of alloys prepared from iodide Ti has shown that, contrary to previously published results, tin appears to form a continuous solid solution with α-Ti at low temperatures, the single-phase region extending at least as far as 25 at.-% Sn. Since at this composition the hexagonal phase is ordered, the change from the random solution to the ordered form is discussed in terms of currently accepted views on the thermodynamics of order-disorder transormations. Below about 1050°C., it has been found that the diffusion rate in Ti–Sn alloys is exceptionally slow, and that equilibrium cannot be achieved in most alloys below 900°C., even after many months of heating. Failure to attain equilibrium in previous micrographic work can account for the observed differences between the present findings and those of other workers. The temperature range examined has been extended by the present work from 1100° to 1600°C. (auth)

9356

THE CONSTITUTIONAL DIAGRAM OF THE SYSTEM CHROMIUM–BERYLLIUM FROM 0 TO 70 ATOMIC PER CENT BERYLLIUM. A. R. Edwards and S. T. M. Johnstone (Dept. of Supply, Melbourne, Australia). J. Inst. Metals 84, 313-17(1956) Apr.

The Cr–Be diagram has been investigated by thermal analysis x-ray diffraction, and metallographic methods, and found to comprise a eutectic system between the Cr-rich solid solution and an intermediate phase based on $CrBe_2$. The eutectic temperature is 1512°C and the melting point of Cr (containing 0·02 wt.-% each of oxygen and nitrogen) is estimated to be 1845°C. The solid solubility of Be in Cr decreases from 9·2 at.-% at 1500°C to 1·5 at.-% at 900°C. The $CrBe_2$ phase exists over a very narrow homogeneity range and, in agreement with previous investigators, is

found to have an $MgZn_2$-type structure. The diagram is compared with that of the analogous Fe–Be system, and some of the phase relationships are discussed. (auth)

9357

EFFECTS OF ALLOYING ELEMENTS OF PLASTIC DEFORMATION IN ALUMINUM SINGLE CRYSTALS. E. E. Underwood and L. L. Marsh, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 477-83(1956) May.

Aluminum single crystals, alloyed with 0.042 at. % Cu and 0.11 and 1.1 at. % Mg, were subjected to constant stress creep test, tensile tests, and hot hardness measurements within a temperature range of 300 to 866°K. Calculations based on Dorn's temperature-compensated time parameter, θ, gave a value of $\Delta H_c = 27{,}000$ cal/mol for the activation energy of early creep in Al single crystals. Correlations have been obtained for Al alloy single crystals with the parameter E for solid solution strengthening, as well as with the parameter F for solid solution hardening, by using a valence of 3 for Al. Limited measurements on tensile specimens show that the slip band density tends to decrease with increasing temperature and with decreasing solute concentration. (auth)

9358

SELF-DIFFUSION IN SOLID NICKEL. R. E. Hoffman, F. W. Pikus, and R. A. Ward (General Electric Co., Schenectady, N. Y.). J. Metals 8, 483-6(1956) May.

The self-diffusion coefficient in high-purity Ni was measured over the temperature range 870 to 1248°C. The results are described by the relation $D = 1.27 \exp[-66{,}800/RT] cm^2 sec^{-1}$. The measured activation energy correlates satisfactorily with absolute melting point, heat of fusion, and heat of sublimation. (auth)

9359

EVALUATION OF THE STRUCTURAL STABILITY OF Ti–Mo–V ALLOYS. W. F. Carew and F. A. Crossley (Armour Research Foundation, Chicago) and H. D. Kessler (Titanium Metals Corp. of America, Henderson, Nev.). J. Metals 8, 491-6(1956) May.

Metastable β alloys in the Ti-rich corner of the Ti–Mo–V system have been studied with respect to their stability upon holding in the temperature range 300 to 550°C. Metallographic examination coupled with hardness measurements were employed to follow structural changes. Ternary alloys in the total alloy content range of 15 to 24 wt. % were found to transform. (auth)

9360

SOME TRANSIENT EFFECTS DURING CREEP AND TENSILE TESTS OF AN ALUMINUM ALLOY. H. A. Lequear and J. D. Lubahn (General Electric Co., Schenectady, N. Y.). J. Metals 8, 497-501(1956) May.

A sudden change from one constant strain rate to another during a tensile test causes an unusual transient in Al alloy 61ST. A sudden change from one constant stress to another during a creep test does not produce an unusual transient in this material. A specially devised test shows that the nature of the previous steady-state conditions, which the sudden change disturbs, is one of the factors affecting the transient behavior. Some of the observations may be explained in terms of strain aging. (auth)

9361

HYDROGEN EMBRITTLEMENT OF A COMMERCIAL ALPHA-BETA TITANIUM ALLOY. E. J. Ripling (Case Inst. of Tech., Cleveland). J. Metals 8, 502-3(1956) May.

Hydrogen embrittlement in alpha-beta Ti alloy was attenuated if the H content was high or eliminated, when H content was moderate, by stretching at a high strain rate. The embrittlement seems to result from the mechanism which produces H embrittlement in steels and is consistent with a competitive rate theory. (F.S.)

9362

PRECIPITATION HARDENING IN A Ti–Cu ALLOY. L. M. Howe, E. Saarema, and J. Gordon Parr (Univ. of British Columbia, Vancouver). J. Metals 8, 512-13(1956) May.

In Ti–Cu alloys at temperatures of 400 to 500°C hardness curves show characteristics of overaging caused by precipitation. It appears that the coherency between the precipitate and the matrice material is short-lived at the temperatures investigated. This may be peculiar to the Ti–Cu system or to the use of samples of very small dimensions. Results indicate that these Ti–Cu specimens are readily susceptible to age-hardening treatments in contrast with the behavior of lump samples which are reported to respond negligibly. (F.S.)

9363

SUBSTRUCTURES IN RETAINED-BETA PHASE OF Ti–Ni ALLOYS. D. H. Polonis and J. Gordon Parr (Univ. of British Columbia, Vancouver). J. Metals 8, 514-15(1956) May.

Intracrystalline boundaries and turn-like appearance were observed in the Ti–Ni substructure. These faults might have been caused by martensite transformation which had been initiated but not detected. (F.S.)

9364

HEAT TREATMENT AND MECHANICAL PROPERTIES OF Ti–Fe ALLOYS. F. C. Holden, H. R. Ogden, and R. I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 521-8(1956) May.

The properties of quenched Ti–Fe alloys have been correlated with their microstructures. For specimens quenched from equilibrium in the α-β field, the dominant microstructural variable is the α-β ratio. A comparison of specimens having equiaxed α-β structures with those having acicular α-β structures shows that the equiaxed specimens have better tensile ductility, but lower impact resistance. There is evidence to show that specimens with acicular structures reach equilibrium in the α-β field more rapidly than specimens with equiaxed structures. Both strength and ductility are lowered by heat treatments below 700°C. (auth)

9365

HIGH-TEMPERATURE X-RAY DIFFRACTION INVESTIGATION OF THE Zr–H SYSTEM. D. A. Vaughan and J. R. Bridge (Battelle Memorial Inst., Columbus, Ohio). J. Metals 8, 528-31(1956) May.

The phase diagram of the Zr–H system over the range 0 to 65 at. % was determined by high temperature x-ray diffraction methods. Results show a eutectoid between α-zirconium and the hydride phase. The eutectoid temperature was established at 560 ± 10°C with a eutectoid composition of 42 ± 3 at. % H. The hydride phase of the lowest hydrogen content is stable only above the eutectoid temperature, but is formed and retained in a metastable state during reaction of Zr with H_2 at temperatures below 560°C. One hydride phase is indicated that exists over the composition range 55 to 65 at. % H. (auth)

9366

PHASE TRANSFORMATIONS IN TITANIUM-RICH ALLOYS OF NICKEL AND TITANIUM. D. H. Polonis and J. Gordon Parr (Univ. of British Columbia, Vancouver). J. Metals 8, 531-6(1956) May.

The formation and subsequent decomposition of metastable phases in Ti–Ni alloys containing up to 11 at. % Ni have been studied. The decomposition of a completely retained β phase and of a completely transformed β phase in a 6 at. % alloy has been followed by x-ray diffraction and metallographic methods and by hardness determinations made during the process. The possible mechanisms of the reactions are discussed. (auth)

9367

STRAIN-INDUCED POROSITY AND HYDROGEN EMBRIT-

TLEMENT IN ZIRCONIUM. F. Forscher (Westinghouse Electric Corp., Pittsburgh). J. Metals 8, 536-43(1956) May.

Pronounced porosity, decreasing with distance from the fracture surface, is found in the necked region of tensile specimens tested at room temperature or liquid N_2 temperature. A hydrogen solution treatment followed by a quench prevents pore formation in tests at –196°C, but has little effect on tests made at room temperature. Reduction of area values at –196°C are strikingly improved by the same treatment, but show no improvement in room temperature tests. The experimental results support the hypothesis that strain-induced porosity results with hydride initially present or, in material containing less than 50 ppm H_2, with hydride precipitated by strain aging. (auth)

9368

SOLID SOLUBILITY OF LITHIUM IN ALUMINUM. S. K. Nowak (Aluminum Labs. Ltd., Kingston, Ont., Canada). J. Metals 8, 553-6(1956) May.

The Li solubility limit in solid Al was determined by the use of micrographic techniques. The solubility limit thus established was shown to be a true equilibrium by checking the reversibility of AlLi phase precipitation and dissolution around the equilibrium temperature. The experimental results fit a straight line by plotting log $N_{(L)}$ against 1/T. The metallurgical reasons explaining the lack of agreement among previous investigations are discussed. (auth)

9369

PRESSURE-TEMPERATURE-COMPOSITION RELATIONS IN THE Cr–N TERMINAL SOLID SOLUTION. A. U. Seybolt and R. A. Oriani (General Electric Co., Schenectady, N. Y.). J. Metals 8, 556-62(1956) May.

The pressure and composition of the solid solution of Ni in Cr has been investigated as a function of temperature. The partial molal heat of solution, the activity of N_2 in solid solution, and the partial molal free energy have been computed. The enthalpy of three reactions is summarized. (auth)

9370

MAGNESIUM–URANIUM SYSTEM. P. Chiotti, G. A. Tracy, and H. A. Wilhelm (Iowa State Coll., Ames). J. Metals 8, 562-7(1956) May.

A summary of analytical, x-ray, thermal, and metallographic data obtained in the study of the Mg–U system is presented. No intermetallic compounds are formed by these two elements, and their mutual solubility is limited at temperatures up to 1255°C. The compositions of the liquids which coexist at 1135°C under a pressure of 3 atm are 0.14 ± 0.05 wt. % U in magnesium, and 0.004 wt.% Mg in uranium. The solubility of U in Mg decreases to 0.05 ± 0.03 wt. % at 675°C, and to about 0.0005 wt. % at 650°C. Due to the reactivity of both U and Mg toward crucible materials, the choice of a suitable crucible presented a problem. Crucibles made from high purity magnesia to which 10 wt. % MgF_2 was added to reduce porosity proved to be satisfactory. Some observations made with the use of other crucibles are given. (auth)

9371

SOLUTE DIFFUSION IN NICKEL-BASE SUBSTITUTIONAL SOLID SOLUTIONS. R. A. Swalin and Allan Martin (Univ. of Minnesota, Minneapolis). J. Metals 8, 567-72(1956) May.

Diffusion rates of Mn, Al, Ti, and W in Ni were measured at temperatures between 1100 and 1300°C. Activation energies, Q, and values of the frequency factor, D_0, were calculated for each system. Values of Q were found to be within 15% of that for self-diffusion of Ni in agreement with present theories of diffusion. (auth)

9372

RE-EXAMINATION OF Ti–Fe AND Ti–Fe–O PHASE RELATIONS. Elmars Ence and Harold Margolin (New York Univ.). J. Metals 8, 572-7(1956) May.

The Ti–Fe and Ti–Fe–O systems were re-examined because of the controversy regarding the existence of Ti_2Fe, and to consider all available data points to the existence of Ti_2Fe. The Ti–Fe–O system contains two ternary compounds: ϵ, corresponding to Ti_2Fe; and γ. (auth)

9373

TITANIUM–MOLYBDENUM–OXYGEN SYSTEM. Paul A. Farrar, Louis P. Stone, and Harold Margolin (New York Univ.). J. Metals 8, 595-600(1956) May.

The Ti–Mo–O system was investigated in the region 0 to 45 wt. % Mo and 0 to 10 wt. % O, from 600 to 1400°C. Solidus data are also presented. Isothermal sections at 700, 900, 1100, and 1300°C, and vertical sections at 1 and 28 wt. % Mo, and 1 and 10 wt. % O are included. (auth)

9374

SIGMA NUCLEATION TIMES IN STAINLESS STEELS. G. F. Tisinai, J. K. Stanley, and C. H. Samans (Standard Oil Co. of Indiana, Whiting). J. Metals 8, 600-4(1956) May.

The times at which the first detectable amount of σ phase forms at temperatures between 900 and 1800°F were determined. Both X-ray diffraction and metallography were used to detect σ in highly strained filings; metallography alone to detect it in annealed bulk samples of 6 different types of stainless steels. The σ phase was found to form in accordance with the C-type reaction curve in both austenitic and ferritic alloys. In filings of types 304, 347, and 446, σ formed in a few hours, and in types 316, 309, and 310, it formed in a matter of minutes at temperatures corresponding to the knee of the C-curve. Only in the bulk type 309 steel, after 500 hr, and in the bulk-type 310 steel, after as short a time as 25 hr at temperature, was σ detected; in both instances at approximately the same optimum temperature as in the filings. The annealing temperature affected σ phase nucleation only for the filings of type 304 and 347 steels, and for the bulk samples of type 309 and 310 steels. (auth)

9375

ON THE USE OF LINEAL ANALYSIS FOR OBTAINING PARTICLE SIZE DISTRIBUTION FUNCTIONS IN OPAQUE SAMPLES. J. W. Cahn and R. L. Fullman (General Electric Co., Schenectady, N. Y.). J. Metals 8, 610-12(1956) May.

A method is derived for obtaining the distribution of sphere diameters and plate thicknesses (or pearlite spacings) from size distribution functions obtained along randomly oriented lines. The method described offers several advantages over existing methods. (auth)

9376

PROPERTIES OF ZIRCALOY-2. D. E. Thomas and F. Forscher (Westinghouse Electric Corp., Pittsburgh). J. Metals 8, 640-5(1956) May.

The use of Zircaloy-2 has increased in proportion to the development of water-cooled reactors. Information has been collected on composition and physical properties, mechanical properties, and corrosion behavior. (F.S.)

9377

INERT ATMOSPHERE WELDING OF ZIRCONIUM AND HAFNIUM. J. S. Theilacker, E. D. Baugh, A. H. Kasberg, and R. B. Stermon (Westinghouse Electric Corp., Pittsburgh). J. Metals 8, 646-7(1956) May.

Zirconium and hafnium are readily weldable to themselves and to each other when they are protected from atmospheric contamination. The low thermal expansivity of these metals and the very small volume change associated with the phase transformations permit the welding of complex structures with a minimum of distortion. These metals and their useful alloys are ductile over the entire temperature range, and the structures resulting from cooling through phase transformations are ductile, but the high chemical activity of these metals requires that an inert atmosphere be provided

during welding. Failure to do so will result in the formation of nitrides, carbides, and oxides which are readily soluble in the metal and which impart brittleness to the weld area and reduce the corrosion resistance of the metal in high temperature and high pressure water. Ordinary inert, gas-shielded, tungsten electrode arc welding equipment is not adequate to prevent contamination to the degree desired for nuclear components. Consequently, special inert atmosphere welding chambers were designed and built. These have given excellent reactor proven results. (auth)

9378

FIRST ZIRCONIUM VESSEL FOR HRT REACTOR. G. E. Elder and E. C. Miller (Oak Ridge National Lab., Tenn.) and L. F. Bledsoe and F. V. Daly (Newport News Shipbuilding and Dry Dock Co., Va.). J. Metals 8, 648-50(1956) May.

The HRT core tank is a spherical vessel with a conical section for the entry of the liquid fuel. Hot forming of complicated shapes reduced the number of welds. Weld fabrication was performed in the open with a blanket of inert gas to protect the weld puddle and the heat-affected zone. (F.S.)

9379

EFFECT OF NUCLEAR RADIATION ON STRUCTURAL MATERIALS. J. C. Wilson and D. S. Billington (Oak Ridge National Lab., Tenn.). J. Metals 8, 665-72(1956) May.

Properties of engineering interest in a wide variety of materials have been reviewed as they are known to be affected by irradiation. Some of the possible implications of the property changes have been noted and logical paths of research have been pointed out. (F.S.)

9380

CONVERSION COATINGS FOR TITANIUM. P. D. Miller, R. A. Jefferys, and H. A. Pray (Battelle Memorial Inst., Columbus, Ohio). Metal Progr. 69, No. 5, 61-4(1956) May.

Both conversion and anodic coatings on Ti alloys were found to hold lubricants efficiently and to eliminate or reduce galling in forming operations and in applications involving metal-to-metal contact. (auth)

9381

DELAYED CRACKING OF ROLLED Ti-150 A. Harold Bernstein (U. S. Naval Gun Factory, Washington, D. C.). Metal Progr. 69, No. 5, 65-6(1956) May.

Centerline cracking of warm-rolled Ti alloy-150 A which occurs after the alloy has cooled to room temperature can be eliminated by a stress-relieving treatment or by proper edge preparation. (auth)

9382

THE DOUNREAY SPHERE. J. McLean. Nuclear Eng. 1, 56-7(1956) May.

The 135-ft diameter containing sphere for the Dounreay reactor was designed for conditions not previously encountered. Colluf 28 and 32 and Lloyds P. 403 steels are being used. Low-hydrogen type electrodes are being used in welding. (F.S.)

9383

ZIRCONIUM. PART I. PRODUCTION. G. L. Miller (Murex Ltd., Rainham, Essex, England). Nuclear Eng. 1, 58-62(1956) May.

Production methods are described, beginning with a review of the iodide process and its limitations, and followed by a description of the Kroll process and simplifications such as the elimination of the purification and densification steps. (auth)

9384

CONTROLLED SPUTTERING OF METALS BY LOW-ENERGY Hg IONS. Gottfried K. Wehner (Wright Air Development Center, Wright-Patterson AFB, Ohio). Phys. Rev. 102, 690-704(1956) May 1.

Sputtering has been studied under well controlled conditions, i.e., low gas pressure (1 micron), defined energy (up to 300 ev) and angle of incidence of the bombarding ions, and high ion-current density (10 ma/cm^2), by immersing the target in a low-pressure Hg plasma of high density created in a pool-type vacuum arc. It turned out that threshold energies (minimum ion energy for sputtering to ensue) are considerably lower under oblique than under normal incidence, and the atoms are ejected away from the direction of incidence. Thresholds were measured for twenty-three metals under normal incident Hg-ion bombardment. They follow, without exception a simple law: The product of the momentum transferred at threshold from ion to target surface atom and the sound velocity of the target material is proportional to the heat of sublimation of the target material. The threshold energies to be expected accordingly in the case of rare gas ion bombardment under normal incidence are tabulated. The yield (atoms per ion) vs ion energy was carefully measured for the case of polycrystalline Pt. When metal single crystals were sputtered, it was discovered that atoms are preferentially ejected in the directions of closest packing, that is [110] in fcc, [111] in bcc and diamond lattice. Deposits sputtered from plane low-index surfaces of single crystals therefore form characteristic patterns. Their study reveals more details: At low ion energy, only such atoms are sputtered which have no obstructing neighbors in the way of a close-packed direction. At higher ion energy, additional atoms are set free from positions where neighbor atoms interfere. Such atoms deviate in a characteristic way from the directions of close packing. Most atoms sputtered in close-packed directions which are parallel to the surface are trapped again, causing growth of oriented hillocks. The possibility for crystal growth by sputtering was demonstrated in another experiment. Some characteristic features of the etch effects caused by sputtering are described. The basic process in sputtering at low ion energies is one of momentum transfer. The important parameters with respect to the gas discharge are ion energy, angle of incidence, and atomic weight of ion; on the target side they are the atomic weight, the elastic constants, crystal structure and orientation, the heat of sublimation, dislocations, and surface roughness. Many details need further clarification, and the studies are being continued. (auth)

9385

ON A THEORY OF THE ELECTRICAL CONDUCTIVITY OF METALS. P. S. Zyrianov (Ural Polytechnical Inst., Sverdlovsk). Soviet Phys. JETP 2, 247-51(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 193-200(1955) Aug. (In Russian)

The fluctuations of potential of the internal electric field in the electron-ion plasma of a metal and the electrical resistivity dependent on the scattering of electrons by these fluctuations are calculated. (auth)

9386

SYMPOSIUM ON METALLIC MATERIALS FOR SERVICE AT TEMPERATURES ABOVE 1600 F—PRESENTED AT THE FIFTY-EIGHTH ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS IN ATLANTIC CITY, N. J., JUNE 30, 1955. ASTM Special Technical Publication No. 174. Philadelphia, American Society for Testing Materials, 1956. 193p. $3.50.

The problem of high-temperature strength of various alloys and their stability is discussed. Properties of Ni-, Co-, and Mo-base alloys, carbides, powder metallurgy techniques, and effectiveness of ceramic coatings for protection against oxidation and erosion are reported. (F.S.)

Refer also to abstracts 9158, 9198, 9230, and 9240.

TRACER APPLICATIONS

9387 AEC-tr-2534

THE APPLICATION OF RADIO-ISOTOPES IN METALLURGY; DETERMINATION OF THE TEMPERATURE INITIATING THE REDUCTION OF OXIDES WITH CARBON. V. P. Elyutin, U. A. Pavlov, and R. F. Merkulova. Translated by F. L. Yaggee from Collection XXXIV of Government Scientific–Technical Publishing House for Literature on Ferrous and Non-Ferrous Metallurgy, Moscow 1955. 5p.

A method is described for determining the temperature at which reduction of an oxide by carbon is initiated. Radioactive carbon is prepared from $BaCO_3$ and CO_2 containing C^{14} and is used to reduce the oxide. Reduction was indicated by the C^{14}–containing gases formed passing an alpha counter tube. An accuracy of ±5°C is claimed. (T.R.H.)

9388

RADIOACTIVITY OF IRON METEORITES BY THE PHOTOGRAPHIC METHOD. S. Deutsch and E. Picciotto (Univ. of Brusells) and F. G. Houtermans (Physikalisches Institut der Universitat, Berne). Nature 177, 885-6(1956) May 12.

PHYSICS

9389 AERE-I/R-1688

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PROMPT GAMMA-RAYS FROM NEUTRON CAPTURE AS A MEANS OF OIL WELL CONTROL. D. B. Smith and G. R. Church. Oct. 26, 1955. 14p.

The interface between oil-saturated strata and brine–saturated strata in an oil well can be located by examining the energy distribution of the gamma rays which arise from the (n,γ) reaction when the strata is subject to a flux of fast neutrons. Operating in a cased and lined well, the counting rate in the brine strata exceeds that in the oil strata by about 10% over a range of γ energies from about 5 to 7 Mev. (auth)

9390 NAA-SR-1637

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SOLID STATE PHYSICS SEMI-ANNUAL PROGRESS REPORT [FOR] JULY–DECEMBER 1955. J. Hove and C. Dixon, eds. Aug. 15, 1956. 55p. Contract AT-11-1-GEN-8. $0.40(OTS).

Three main fields of study are covered: electronic structure of Th, U, and Pu; transport phenomena in reactor materials; and crystal defects and damage mechanisms. For studies on electronic structure of heavy metals, equipment is described for work at high and very low temperatures and with very stable strong magnetic fields. Data are given on resistivity and magnetoresistivity of Th and U, on the Hall coefficient for U, and magnetic susceptibility of Th. Salient features of a variational method for computing energy contours in actinide atoms are developed. The proposed method is used to compute the electronic specific heat, with results that compare favorably with observed data. Electron irradiation of graphite at liquid-helium temperature and subsequent pulse annealing at successively higher temperatures is described. It is shown that no annealing occurs below 78°K. Annealing of irradiated graphite at 78°K is indicated by charting changes in x-ray-diffraction. The indicated behavior is held to support hypothesis that the considerable annealing between 175°K and 300°K is due to reintegration of close vacancy interstitial pairs. Possible models to explain interstitial thermal diffusion are discussed. An experiment to study thermal self-diffusion in metals is outlined. As the result of a study of annealing recovery of electrical resistivity in electron-irradiated copper, conclusions are drawn which extend an earlier model for mechanisms of radiation damage. Another experiment is described in which irradiation of Cu with 1.25-Mev electrons produces an annealing effect. Electron irradiation of white tin, without transformation to grey tin, is also described. A displacement spike concept is held to be consistent with this result. In another electron irradiation study, the threshold displacement energy in Ni is found to be 34.5 ev. (auth)

9391 WADC-TR-53-133(Pt. 1)

Plax Corp., Hartford, Conn.

INVESTIGATION OF THE SHELF LIFE OF LIQUIDS IN POLYETHYLENE BOTTLES. Jules Pinsky, A. R. Nielsen, and James H. Parliman. June 1954. 127p. Contract AF33(616)-112. (AD-43189).

The shelf life of 80 especially selected liquids and solids in blown Plax 4 ounce polyethylene bottles was investigated at temperatures from 32 to 165°F. Permeability factors for these materials are presented as well as packageability suitability. The suitability of packaging these 80 materials in blown polyethylene bottles of capacities from 32 ounces to 13 gallons is tabulated. Physical effects on the polyethylene and chemical changes in the materials are described. The effect of liquid and vapor phases, as well as the molecular weight of the chemicals, on permeability is discussed. (auth)

9392 AERE-Lib/Trans-603

THE BEHAVIOUR OF THE NATURAL CIRCULATION IN WATER-PIPE BOILERS WITH A FALLING BOILER PRESSURE. O. G. Hammar and R. Jung. Translated by R. J. Richardson from Brennstoff-Wärme-Kraft 7, 1-10(1955). 26p.

It has been supposed that a disturbance in the circulation current detrimental to the heated up-pipes is to be expected when a falling off of boiler pressure owing to loading shocks leads to a self-vaporization of the water in the down-pipes. With an apparatus constructed as a section of a ready-made boiler of normal size for the examination of natural circulation the loading shocks, which arise in practice through a blowing off of steam, were imitated and the resulting variable velocities in circulation were measured. The limiting value of the temporary fall in pressure obtained from this $\Delta p/\Delta t$ exceeding which a disturbance in circulation occurs, depends in the main upon the initial values of the boiler pressure and the water velocity in the down-pipe. By the use of higher water velocities in the down-pipes and the greatest possible initial heating of the up-pipes, the behavior of the water circulation during loading shocks is favorably influenced. On the other hand an aritificial throttling of the circulation current by means of shutters of throttle obstruction leads far more easily to disturbances of circulation. Under normal conditions, especially with greater initial values of water velocities in the down-pipe, the permissible temporary fall in pressure is considerably greater than the limiting value which signals the beginning of self-vaporization of the water contents in the down-pipe. (auth)

9393 NACA-TM-737

CONVERSION OF ENERGY IN CROSS-SECTIONAL DIVERGENCES UNDER DIFFERENT CONDITIONS OF INFLOW. (Energieumsetzung in Querschnittserweiterungen bei Verschiedenen Zulaufbedingungen). H. Peters. Translated from Ing. Arch. 2, 92-107(1931). 24p.

This investigation treats of the conversion of energy in conically divergent channels with constant opening ratio and half included angle of from 2.6 to 90°, the velocity distribution in the entrance section being varied from rectangular

distribution to fully developed turbulence by changing the length of the approach. The energy conversion is not completed in the exit section of the diffuser; complete conversion requires a discharge length which depends upon the included angle and the velocity distribution in the entrance section. For that reason the efficiency (ratio of rise of pressure energy to difference of kinetic energy of mean velocity) was determined, once for the diffuser alone, then with the discharge length necessary for complete conversion. These efficiencies are, in part, widely at variance, and it was found that the velocity distribution in the entrance section affects the pressure conversion very profoundly in the diffuser, alone, but only very little in the diffuser with exit length. A comparison with Gibson's experiments at a greater opening ratio, concedes the efficiency to be dependent on this ratio, especially for large included angles. The conversion losses proportionate to the losses by sudden divergence (Carnot loss) are preferable to the efficiency. (auth)

9394

THE FUTURE ROLE OF ATOMIC ENERGY IN INDUSTRY, SCIENCE AND MEDICINE. John Cockcroft (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Radiol. 29, 256-60(1956) May.

Applications of atomic energy for nuclear power production, in industry, in medicine, and in science are reviewed. Predictions are made as to increasing uses within the near future. Schematic sketches of a gas-cooled power reactor and of a β-backscattering thickness gage are included. (C.H.)

9395

THERMAL AND ELECTRICAL CONDUCTIVITIES OF THE ALKALI METALS AT LOW TEMPERATURES. D. K. C. MacDonald, G. K. White, and S. B. Woods (National Research Council, Ottawa, Canada). Proc. Roy. Soc. (London) A235, 358-74(1956) May 8.

9396

STELLAR MODELS BASED ON THE PROTON-PROTON REACTION. Peter Naur. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 16, 1956. 49p.

Since the p-p chain reaction may provide the greater part of the energy production of dwarf stars, a new type of stellar model has become important. A method for the integration of the equations of stellar equilibrium is outlined, and applications of the models to the sun and the H-He star are discussed briefly. (B.J.H.)

9397

THE APPLICATION OF CESIUM-134 TO INDUSTRIAL RADIOGRAPHY. James W. Dutli and Dana E. Elliott (Los Alamos Scientific Lab., N. Mex.). Non-Destructive Testing 14, No. 2, 24-7(1956) Mar.-Apr.

AEROSOLS

9398

ON MOTION OF AEROSOL PARTICLES IN A DIFFUSING FIELD. B. V. Deryagin and S. S. Dukhin (Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 106, 851-4(1956) Feb. 11. (In Russian)

Forces acting on a drop in a homogeneous diffusing field are investigated to determine the behavior of the drop near the evaporation and condensation surface. Drop evaporation appeared more intensive in the direction of the outer diffusion flow. That should mean that the field of vapor concentration in the vicinity of the drop, conditioned by the drop evaporation and by the outer diffusion, are asymmetrically related to field velocities and flow pressures. (R.V.J.)

ASTROPHYSICS

9399 CRP-652

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

NUCLEAR REACTIONS IN STARS AND NUCLEOGENESIS. A. G. W. Cameron. July 1956. 30p. (AECL-340). $1.00 (AECL).

Evidence obtained from current astrophysical studies indicates that elements heavier than H have been formed in stellar interiors and then expelled to the interstellar medium. Current theories of stellar evolution are outlined and it is shown that by combinations of H and He thermonuclear reactions many of the light elements can be formed in stellar interiors. The capture of neutrons formed by exothermic (α,n) reactions forms certain isotopes of the heavy elements. It appears likely also that the abundance peak at Fe is a product of high temperature statistical equilibrium in pre-supernovas, and that medium-weight and heavy elements are products of supernova explosions. (auth)

COSMIC RADIATION

9400

STUDY OF THE NUCLEAR COMPONENTS OF COSMIC RADIATION NEAR THE EQUATOR BY MEANS OF SENSITIVE EMULSIONS. Tsai-Chu. Ann. phys. (13) 1, 291-343 (1956) Mar.-Apr. (In French)

Detailed discussions are included on the zenithal distribution of the angular intensity, the existence and variation of the East-West asymmetry, the absolute vertical intensity, and the latitude effect. (B.J.H.)

9401

ORIGIN OF COSMIC RAYS. V. L. Ginzburg (Lebedev Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 5-16(1956) Jan. (In Russian)

Cosmic rays are generated mostly in the shell of a super-new, new, or any other non-stationary star. Acceleration of particles takes place under the effects of statistical mechanism which is more effective in the shells of non-stationary stars than in the interstellar area. Emitting from the shells of the super-new (or any similar non-stationary star) into the interstellar region the cosmic rays diffuse and scatter on the interstellar magnetic fields. As a result the scattered particles and the discharged interstellar gas occupy the quasi-atmospheric area (subsystem) with the radius of galactic order of ($R \sim 10^{23}$ cm). In the process of circulating between the interstellar region the cosmic particles do not acquire any energy as the statistical mechanism of interstellar acceleration is not effective. The electron energy losses are mostly due to the magnetic bremsstrahlung which produces the cosmic radiation. Proton and atom energy losses result mostly from the atomic collisions. The data published up to the year of 1955 are reviewed and discussed. (R.V.J.)

9402

ON THE ORIGIN OF VARIATIONS IN COSMIC RAYS. L. I. Dorman (Research Inst. of Earth Magnetism). Izvest. Akad. Nauk. S.S.S.R. Ser. Fiz. 20, 24-46(1956) Jan. (In Russian)

The method of coupling coefficient combined with the evaluation theory of meteorological effects enables one to make a thorough analysis of various components of cosmic rays at different latitudes and altitudes above the sea level, and at various depths under ground, so as to determine the basic properties of the sources of the variations, the energy spectra, and the direction of the sources. New data were obtained about the magnetic properties of corpuscular currents: "freezing" of the currents in magnetic fields;

division of currents into two types, one type carrying weak ($\sim 10^{-5}$Oe near the earth) magnetic fields, related respectively to the high and low latitudinal formations on the sun; and comparatively negligible dependence of the first-type current and the strong dependence of second type current on the degree of solar activities and other activities. Also, some new data were obtained concerning the turbulent motion of heterogeneities in solar chromospheric eruptions and the values of the magnetic fields "frozen" in them, the general galactic magnetic field, and the distribution of cosmic-ray sources in it. (R.V.J.)

9403

RESULTS OF INVESTIGATIONS OF HARD COMPONENT VARIATIONS IN COSMIC RAYS. E. S. Glokova (Research Inst. of Earth Magnetism). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 47-54(1956) Jan. (In Russian)

The Feenberg-Dorman theory of temperature effects is useful for obtaining correct evaluations of variations caused by temperature. The accuracy of the method is determined by the accuracy of the available aerological data. All variations in the universe (except the flashes) were observed as variations in meson component intensity, and all belonged to the same type of variations. Processes which cause the variations are related to corpuscular currents which cause magnetic storms and turbulences. To variations of this type belong the cyclic, long-lasting, yearly variations in the magnetic storms, the irregular day-to-day oscillations of the universe, and the 27-day variations. According to experimental data, the daily variations of the space components are caused by the processes which also cause the magnetic variations in the general intensity of cosmic rays. (R.V.J.)

9404

VARIOUS INTENSITIES OF COSMIC RADIATIONS AT HIGH ELEVATIONS. Yu. I. Logachev and Yu. G. Shafer (Lomonosov Moscow State Univ.) Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 55-8(1956) Jan. (In Russian)

Variations of cosmic radiation at 300 g-cm^{-2} altitude pressure were measured on a telescope without an absorber. The instrument had two independent channels and the coincidence measurements were used for controlling purposes. In all 22 flights, the intensities registered in both channels coincided within 0.1%. The total error was of 0.3% order, mostly because of the inaccurate measurement of altitude. The intensities measured at 300 g-cm^{-2} altitude over Moscow coincided with the ones measured over Yakutsk. Such close coincidence of variations at 300 g-cm^{-2} altitude pressure, in such different regions, indicate that they must have been caused by the same variations of primary radiation. The measurements were made during the year of minimum solar activity which may account for the reason why measurements showed such negligible variations. Also, it may be assumed that the magnitude of variations depends on variations in solar activity. (R.V.J.)

9405

AN ABNORMAL, SUDDEN RISE OF THE INTENSITY OF COSMIC RADIATION. R. Steinmaurer. Naturwissenschaften 43, 174(1956) Apr. (In German).

9406

THE DAILY VARIATION OF THE COSMIC RAY INTENSITY MEASURED NEAR THE 1954 SUNSPOT MINIMUM. M. Possener and I. J. van Heerden (Univ. of Manchester, England). Phil. Mag. (8) 1, 253-60(1956) Mar.

Measurements of the daily variation of the cosmic ray intensity at sea level during the past few years have revealed the presence of changes in amplitude and phase of the variation. In particular, during 1953 and 1954, which were years of minimum sunspot activity, the variation has shown remarkable changes over the course of the year. During July, August and September 1953, the time of maximum intensity of the ionizing component occurred at about 23 hours, whereas for the rest of the year it was near 10 hours. Again, during the period June to November 1954, the time of maximum was at 03 hours compared with 10 hours for the remainder of the year. During these months of anomalous behaviour, the amplitude of the daily variation for the nucleonic component decreased to a value which was not statistically different from zero. These remarkable changes in the daily variation seemed to have been a peculiarity of the 1954 sunspot minimum since, as far as can be seen, there were no comparable changes during the 1944 minimum. (auth)

9407

SPEED MEASUREMENT OF COSMIC-RAY PARTICLES USING MILLIMICROSECOND TIMING CIRCUIT. C. N. Chou (Virginia Polytechnic Inst., Blacksburg). Phys. Rev. 102, 848-50(1956) May 1.

The speed of cosmic-ray particles was measured using a three-channel time-interval-measuring modified chronotron circuit. Results concerning μ-mesons agree with those theoretically expected. For cosmic-ray particles of speeds higher than 0.64 times that of light, about 1.5 ± 0.8 percent of high-speed ionizing particles (excluding electrons) at sea level are protons. (auth)

9408

TIME STRUCTURE OF COSMIC-RAY SHOWERS. R. Sugarman and S. DeBenedetti (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 102, 857-61(1956) May 1.

The time structure of extensive air showers at sea level has been measured by coincidence of liquid scintillation detectors and auxiliary Geiger tubes. The standard time deviation relative to the mean of single electrons is found to be 2 ± 2 mμ sec; the same quantity for single particles capable of penetrating 20 cm of Pb is 6 ± 2 mμ sec. The mean delay of penetrating particles relative to electrons is 0.9 ± 1.3 mμ sec. (auth)

9409

COSMIC-RAY OBSERVATIONS AT VERY HIGH ALTITUDES DURING PERIODS OF INTENSE SOLAR ACTIVITY. Martin A. Pomerantz (Bartol Research Foundation of The Franklin Inst., Swarthmore, Penna.). Phys. Rev. 102, 870-8(1956) May 1.

The records of a number of balloon flights which coincided with outstanding solar disturbances during the period 1947 to 1952 have been subjected to detailed statistical analysis in a search for associated fluctuations in the primary cosmic-ray flux. The intensity at very high altitudes was enhanced in four cases, and normal on five occasions when rf radio disturbances and/or visually-observed solar flares occurred. In some instances, outstanding chromospheric eruptions are not accompanied by any detectable increase in the flux of primary cosmic-ray particles even down to the very low energy required for just penetrating 10 g/cm^2 of matter. On the other hand, additional low-energy particles apparently associated with solar disturbances sometimes are detected at very high altitudes, even when the flares are small and the observing station is outside the morning impact zone. (auth)

9410

ENERGY DISTRIBUTION OF NEUTRAL MESONS PRODUCED IN COSMIC-RAY STARS. Young B. Kim (Princeton Univ., N. J.). Phys. Rev. 102, 882-90(1956) May 1.

A cloud-chamber study of the energy distribution of neutral mesons produced in cosmic-ray stars is reported. The cloud chamber contained a NaI scintillation crystal plate and was triggered when a nuclear interaction in the crystal caused a scintillation light pulse. Photons associated with nuclear interactions produced visible soft showers in passing through several lead plates placed below the

crystal plate, and their energies are estimated from the sizes of these showers. It is concluded that the majority of photons associated with cosmic-ray stars arise from the usual mode of neutral meson decay, i.e., $\pi^0 \rightarrow 2\gamma$. The energy distribution (differential) of the neutral meson is given as a power-law spectrum of exponent $\nu = -1.5 \pm 0.2$ for π^0 energy between 400 and 900 Mev and $\nu = -2.7 \pm 0.5$ for π^0 energy between 900 and 2000 Mev. The data are consistent with an extension of the power-law spectrum given above up to a π^0 energy of about 5000 Mev. (auth)

9411

CLOUD-CHAMBER STUDY OF THE SECOND MAXIMUM. Bartow Hodge and Lloyd W. Morris (Louisiana State Univ., Baton Rouge). Phys. Rev. 102, 1164-7(1956) May 15.

A 12-in. G-M tube controlled cloud chamber was used to study the second maximum of the shower transition curve for lead. Stereoscopic pictures were taken to study the angular divergence of the pairs produced. Over 14,000 photographs were analyzed for a range of lead thickness from 10 to 23 cm. The frames with pairs were reprojected and the angular divergence of the tracks measured with a protractor. The experimental results appear to indicate a second maximum at a thickness in the neighborhood of 17.5 cm lead. (auth)

9412

INFLUENCE OF GEOMAGNETIC QUADRUPOLE FIELDS UPON COSMIC-RAY INTENSITY. F. S. Jory (Univ. of Chicago). Phys. Rev. 102, 1167-73(1956) May 15.

The effect upon cosmic-ray particles of the quadrupole part of the earth's magnetic field has been calculated, using the results of the magnetic survey of 1945. The effect predicted from the zonal quadrupole term is a northern shift of the cosmic-ray latitude curve. The 1945 magnetic center was calculated, using Schmidt's method, and it is 0.0629 earth radii from the center of the earth, as compared to 0.0536 earth radii in 1922. The shift in magnetic center results in an increase in the predicted longitude effect. The residual or sectorial quadrupole effect upon cosmic-ray intensity is predicted to be a two-period sine curve in the longitude effect. (auth)

9413

A COUNTER EXPERIMENT WITH PENETRATING SHOWERS PRODUCED BY μ MESONS. Dan Kessler and Roland Maze (École Normale Supérieure, Paris). Physica 22, 69-85(1956) Feb. (In French).

A penetrating shower counter-arrangement has been operated at sea-level, as well as at 10 and 65 mwe underground, with the purpose to study production of penetrating showers by μ mesons. The contribution of soft showers produced by μ mesons has been made negligible by using an 18.5 cm Pb absorber between extreme counter-trays. The analysis of hodoscopic data obtained with different absorber thicknesses made it possible to separate multiple electromagnetic interactions from true penetrating showers. The following cross-sections for production of penetrating showers by μ mesons with at least 2 secondary particles able to penetrate 18.5 cm Pb have been obtained: at 10 mwe underground: $(1.16 \pm 0.54) \cdot 10^{-30}$ cm^2/nucleon, at 65 mwe underground: $(1.22 \pm 0.45) \cdot 10^{-30}$ cm^2/nucleon. (auth)

9414

INVESTIGATION OF THE STRUCTURE OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. A. T. Abrosimov, A. A. Bedniakov, V. I. Zatsepin, Iu. A. Nechin, V. I. Solov'eva, G. B. Khristiansen, and P. S. Chikin. Soviet Phys. JETP 2, 357-60(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 693-6(1955) Nov. (In Russian)

The spatial distribution of charged particles in cosmic ray showers was studied by using groups of counters of various areas. Results are discussed in some detail. (B.J.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

9415 AFCRC-TN-56-235

Ohio State Univ. Research Foundation, Columbus. CHARGE DISTRIBUTION AND CHARACTERISTIC TEMPERATURE OF METALLIC LITHIUM FROM X-RAY SCATTERING AT 300° AND 100°K. Technical Report No. 1. Paul L. Splitstone and P. M. Harris. Apr. 1956. 30p. RF Project 567. Contract AF18(600)-769.

The Laue-Bragg scattering of single crystals of metallic Li has been measured at 100 and 300°K. These results were placed on an absolute basis by comparison with theoretical atomic form factors for the Li ion and also were compared experimentally with rock-salt. From these results a characteristic temperature, $\Theta = 325$°K, was derived. Electron density computations suggest no appreciable charge concentration between nearest neighbor atoms. To the accuracy of the measurements lithium metal may be well represented by the simple model of lithium ions immersed in a uniform charge distribution of the valence electrons. These results and the implications of the method of treatment are discussed. (auth)

9416 OSR-TN-56-164

Brown Univ., Providence. Metals Research Lab. A QUANTITATIVE THEORY OF GRAIN BOUNDARY MOVEMENT AND RECRYSTALLIZATION IN METALS IN THE PRESENCE OF IMPURITIES. Kurt Lücke and Klaus Detert. Apr. 15, 1956. 32p. Contract AF18(600)1495. (AD-86585).

The influence of small amounts of impurities upon recrystallization are briefly reviewed and a quantitative atomistic theory of these phenomena has been developed. In this theory it is assumed that interaction forces exist between the foreign atoms in solid solution and the boundary, increasing the concentration of foreign atoms in the boundary. At high concentrations (or low temperatures) the moving boundaries are held back by the foreign atoms and the speed of the boundary is controlled by the speed of the foreign atoms diffusing behind the boundary. At low concentrations (or high temperatures) the boundary cannot be held by the foreign atoms, breakaway occurs and the boundary moves much faster. Below the critical concentration for which breakaway just occurs the recrystallization temperature drops much faster with decreasing concentration than it does above this concentration. The quantitative formulation of these ideas leads to expressions for the absolute rate of boundary migration, its temperature dependence, for the activation energy of recrystallization, etc. They agree very well with the experimental results so far available. The fact that the influence of a foreign element upon the rate of recrystallization increases with increasing difference in atomic radius between the solute and the basic metal shows the interaction between boundary and foreign atoms is largely of elastic nature. Further experiments to check the theory more thoroughly are outlined. (auth)

9417

SLIP IN CRYSTALS OF THE CAESIUM CHLORIDE TYPE. W. A. Rachinger and A. H. Cottrell (Univ. of Birmingham, England). Acta Met. 4, 109-13(1956) Mar.

Crystals of ordered beta brass slip along <111>; those of ammonium and thallium halides slip along <100>. These observations can be interpreted in terms of partial dislocations in the simple cubic lattice of the cesium chloride structure. When the ordering forces are large, these partials are pulled together in pairs by the tension of the superlattice stacking faults between them, and the perfect dislocations thus created can produce slip along <100>. When the ordering forces are small, the partials remain dissociated and can produce slip along <111>. An estimate of the critical

ordering energy leads to the view that some intermetallic compounds of this crystal type ought to slip along <100>. Experiments were made to test this view on various single crystals, the conventional method of slip traces and the prismatic punching method of Smakula and Klein being used to determine the glide elements. The results show that CuZn and AgMg slip along <111>, and that AuCd, AuZn, LiTl, MgTl, Tl(Br, I), and Tl(Cl, Br), slip along <100>. (auth)

9418

THE TEMPERATURE DEPENDENCE OF THE ELASTIC CONSTANTS OF GOLD–CADMIUM ALLOYS. Stanley Zirinsky (General Electric Co., Schenectady, N. Y.). Acta Met. 4, 164-71(1956) Mar.

The temperature dependence of the dynamic elastic constants (Moduli of Compliance, S_{11}, S_{12}, and S_{44}) of body-centered cubic Au-Cd alloys that undergo diffusionless phase change, has been determined as a function of composition variation within the beta phase, and heat treatment prior to measurement. The results are consistent by comparison with compressibility calculations and data available for an isomorphous material, beta brass. Derived quantities are similarly comparable. The abnormally high elastic shear anisotropy, $2(S_{11}-S_{12})/S_{44}$, increasing with decreasing temperature, leads to the consideration of an elastic shear anisotropy criterion for diffusionless transformation of body-centered cubic beta-phase alloys. 47.5 at. % Cd alloys water-quenched from 500 and 550°C yield elastic constant data and a diffusionless transformation temperature consistent with that for a 50 at. % Cd alloy. An interpretation of the latter phenomena is offered, based upon the elastic interaction of quenched-in vacancies with neighboring metal ions. (auth)

9419

THE CRYSTAL STRUCTURE OF Cr_5Si_3. Carol H. Dauben, D. H. Templeton, and C. E. Myers (Univ. of California, Berkeley and Purdue Univ., Lafayette, Ind.). J. Phys. Chem. 60, 4435(1956).

The compound Cr_5Si_3 is tetragonal, space group 14/mcm with a = 9.170 ± 0.006 A, C = 4.636 ± 0.003 A, 4 Si in (a), 8 Si in (h) with x = 0.165, 4 Cr in (b), and 16 Cr in (k) with x = 0.075, y = 0.224. (auth)

Refer also to abstract 9236.

ELECTRICAL DISCHARGE

9420 UCRL-4466((Pt. III)(Del.))

California. Univ., Livermore. Radiation Lab.

PART III. MACHINE CALCULATIONS FOR THE ANALYSIS OF THE PLANE IMMOBILIZED PLASMA BY TRAJECTORIES. Lewi Tonks and Ralph Keirstead. Mar. 8, 1955. Decl. with deletions Aug. 15, 1956. 19p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The analysis of an immobilized plasma by trajectories for the Cartesian case has been adapted to machine calculation and the results of such calculations are described. Their most surprising feature is the thinness of the transition layer between a vacuum and a uniform plasma, which is possible without assuming too extreme physical circumstances. (auth)

9421

ON THE EMISSION OF ELECTRONS IN UNIFORM MOTION IN ELECTRON PLASMA PLACED IN MAGNETIC FIELD. A. A. Kolomenskii. Doklady Akad. Nauk S.S.S.R. 106, 982-5 (1956) Feb. 21. (In Russian)

A specific electromagnetic wave emission (Cherenkov effect) accompanies electron uniform motion in a medium with dielectric constant ϵ, when the condition $n > (1/\beta)$ (1) is fulfilled; $\beta = v/c$, v is the electron velocity; n is the refraction coefficient, in isotopic media equal to $n = \sqrt{\epsilon}$ (2). For the case of electron plasma, the expression for ϵ can be taken as: $\epsilon(\omega) = 1-(\omega_0^2/\omega^2)$ (3), where ω is the wave expanding frequency; ω_0 is the plasma frequency $\omega_0 = \sqrt{(4\pi Ne/m)}$ (4), N is number of electron in a volume unit, e is the electron charge and m is the mass. From (2) and (3) it is seen that the wave expansion phase velocity exceeds the velocity of light, consequently, the condition of (1) is not fulfilled and the Cherenkov effect in plasma is impossible. V. I. Veksler observed that the Cherenkov effect in plasma can be fulfilled only when the plasma is placed in a magnetic field. Studies are made to investigate this phenomenon in a magnetic field. (R.V.J.)

9422

FIELD DESORPTION. Erwin W. Müller (Pennsylvania State Univ., University Park). Phys. Rev. 102, 618-24(1956) May.

Field desorption of barium, thorium, oxygen, and some other adsorbates is studied in a field emission microscope with reversed polarity as a function of field strength, temperature and degree of coverage. The desorption occurs in the 100, 200, and 500 million volts/cm range, for the three substances, respectively. At the highest fields the tungsten substrate itself evaporates at room temperature. The quantitative interpretation of the measurements suggest that field desorption be considered as an evaporation of ions in which the energy hump is reduced by the Schottky effect. (auth)

ELECTRONS

9423 NRL-4733

Naval Research Lab., Washington, D. C.

ANOMALOUS ELECTRON EMISSION FROM METALLIC SURFACES. Franz R. Brotzen. Apr. 4, 1956. 11p. Project No. NR-642-060.

Low-melting metals and alloys were heated in a Geiger-Muller free-flow tube and the electron emission from their surfaces was observed. The solidification process in Sn, Bi, and Cd is associated with an anomalously high emission rate. No emission peaks were observed during the solidification of Pb, Pb–Sn alloys, and a Cd–Sn alloy. In the cases of Pb and a Cd–Sn alloy, however, emission peaks were observed during the heating cycle at temperatures below the melting point. Earlier work of the emission effect (Kramer effect) is reviewed and possible mechanisms are discussed. (auth)

9424

DETERMINATION OF EFFECTIVE CROSS SECTION RELATION OF PHOTOELECTRON CAPTURE AND RECOMBINATION OF OPTICAL ELECTRONS IN ZnS–Cu AND Co CRYSTAL PHOSPHORS. Syuĭ Synĭ-Yun(Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 106, 818-21(1956) Feb. 11. (In Russian)

Effective cross sections of free electron σ capture and their recombination σ_0 by ionized phosphorescene centers play an important part in phosphorescent kinetics. Thermal and optical electrons act differently because of the differences in their energies and should be considered separately. An attempt has been made to establish the difference between σ_0/σ for thermal and optical electrons. The curve evaluation has been made of σ_0/σ for thermal electrons with natural attenuation and for the curves of optical electrons with forced attenuation caused by infrared light. Phosphors ZnS – Cu(10^{-4}), Co(6×10^{-6}) with $CaCl_2$(5%) as fusing agent prepared in nitrogen atmosphere at 1100°C was used. The coincidence of the experimental curves of attenuation with thick layers and the theoretical ones calculated for the infinitely thin layers indicate the negligible effect of phosphor thickness on the absorption of light. (R.V.J.)

9425
AXIALLY SYMMETRICAL ELECTRON BEAMS OF A GIVEN FORM. V. T. Ovcharov. Doklady Akad. Nauk S.S.S.R. 107, 47-50(1956) Mar. 1. (In Russian)

Mathematical analysis is given of the general problem concerning the formation of axially symmetrical electron beams with the consideration of the space charge in them. (R.V.J.)

9426
ON THE RANGE-ENERGY CURVE FOR SLOW ELECTRONS IN NUCLEAR EMULSIONS. Jean-Pierre Lonchamp and Christiane Gegauff (Universite de Strasbourg, France). J. phys. radium 17, 132-3(1956) Feb. (In French)

The problem of range-energy relations for slow electrons is treated in a semi-theoretical manner, taking into account the heterogeneous structure of photographic emulsions. The calculation is made in two steps: a calculation of the electron range in gelatine; and a determination of the mean number of developable grains. (tr-auth)

9427
THE MEAN FREE PATH OF CONDUCTION AND PHOTOELECTRIC ELECTRONS MEASURED BY THE THIN-LAYER METHOD. H. Mayer, R. Nossek, and H. Thomas. J. phys. radium 17, 204-9(1956) Mar. (In French)

9428
SCATTERING OF SECONDARY ELECTRONS EXCITED BY 22-MEV X RAYS. M. Tubiana, J. Dutreix, and A. Dutreix. J. phys. radium 17, phys. appl. suppl., 12A-17A(1956) Mar. (In French)

A theoretical and experimental study was made of the secondary electrons emitted by the shield material irradiated by 22-Mev betatron x rays. The intensity of the electron flux decreases rapidly, and becomes less than 5% of its original value at 40 cm outside of the shield. (tr-auth)

9429
BACKSCATTERING OF ELECTRONS BY SOLUTIONS AND ALLOYS. Louis Danguy and Robert Quivy. J. phys. radium 17, 320-5(1956) Apr. (In French)

The phenomenon of backscattering and the factors upon which it depends are reviewed. Results of experimental work on solutions and alloys using Tl^{204} and Cs^{137} sources are summarized. They show that the number of backscattered particles is a function of the effective atomic number which can be calculated by a simple equation. Moreover, in the case of solutions, the square of the number of scattered particles is a linear function of the product of this effective atomic number by the specific weight of the solution considered. (tr-auth)

9430
ACCELERATION OF ELECTRONS BY AN EXTERNAL FORCE FIELD. E. N. Adams and P. N. Argyres (Westinghouse Research Labs., East Pittsburgh, Penna.). Phys. Rev. 102, 605-6(1956) May 1.

The usual proof that an electron in an energy band reacts to an external force as though it had an effective mass is shown to be invalid. It is shown, however, that for static externally applied fields, modified (field-dependent) energy bands can be found for which the acceleration theorem is rigorously correct. (auth)

9431
FREE-RADICAL QUENCHING OF POSITRON LIFETIMES. Stephan Berko and A. Joseph Zuchelli (Univ. of Virginia, Charlottesville). Phys. Rev. 102, 724-8(1956) May 1.

The annihilation lifetime of positrons stopping in benzene has been measured as a function of the percentage of added free radical, diphenylpicrylhydrazyl. The long component of the complex annihilation curve quenches from 2.67×10^{-9} sec in pure benzene to 5.3×10^{-10} sec at a 3% free radical concentration. An annihilation model following Bell and Graham's assumptions is discussed, postulating the partial formation of bound positron states prior to annihilation. The long lifetime is regarded then as a measure of the conversion rate from triplet to singlet states due to collisions of the positron system with the unpaired electrons of the free radical. The experimental points yield, using such a model, a conversion cross section of $\sigma = 1.18 \times 10^{-17}$ cm^2. (auth)

9432
VARIATION WITH ELECTRON ENERGY OF THE COLLISION CROSS SECTION OF HELIUM FOR SLOW ELECTRONS. J. M. Anderson and L. Goldstein (Univ. of Illinois, Urbana). Phys. Rev. 102, 933-8(1956) May 15.

The method of interaction of microwaves in gaseous discharge plasmas has been applied to a determination of the variation of the effective collision cross section for momentum transfer, q_m, of helium atoms with electrons having energies from 0.04 to 0.4 ev. Under these experimental conditions with electron densities $\gtrsim 10^{10}$ electrons/cc, appropriate charge interactions have been considered. The mean fraction of excess energy loss of slow electrons upon collision, G, was found to be $\sim 2.7 \times 10^{-4}$, the expected 2m/M value. (auth)

9433
LIFETIME OF POSITRONS IN SUPERCONDUCTING LEAD. B. Green and L. Madansky (Johns Hopkins Univ., Baltimore). Phys. Rev. 102, 1014-15(1956) May 15.

Comparison of the mean lifetime of positrons in lead at 4.2°K with that at 10°K indicates (a), no change greater than 2×10^{-10} sec in the short-lived component, and (b), no more than 0.3% abundance of a component with lifetime greater than 2×10^{-9} sec. (auth)

9434
DEPENDENCE OF ELECTRON REFLECTION ON CONTAMINATION OF THE REFLECTING SURFACE. G. A. Harrower (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 102, 1288-94(1956) June 1.

Measurements of the reflection of electrons from a tungsten target have been made using electron energies from 3 to 1000 volts. It was found that the reflection of electrons changed considerably during the formation of the first monolayer of contamination on the surface and thereafter remained constant. Whether the change was an increase or a decrease depended on the energy of the electrons. (auth)

Refer also to abstract 9655.

GASES

9435 RAOP-2
RAND Corp., Santa Monica, Calif.
A SIMPLIFIED METHOD FOR COMPUTING THE EQUILIBRIUM COMPOSITION OF GASEOUS SYSTEMS. F. J. Krieger and W. B. White. Revised Jan. 9, 1948. 10p.

A simplified procedure is described for computing, either manually or by means of punched cards, the equilibrium composition of a gaseous system of any degree of complexity. The method presents a system of n equations in n unknowns in such a form that each of the major components is given as a linear expression of the minor components only, while the logarithm of each of the minor components is given as a linear expression in terms of the free energy change for the dissociation reaction which defines the minor component and the logarithms of the major components and the total pressure. An iteration process then gives an exact solution with a rapidity which decreases as the fuel-oxidant mole ratio approaches the stoichiometric value. (auth)

9436
USE OF THE IONIZATION PRODUCED BY α RAYS FOR THE MICROANALYSIS OF GAS. Marc Lefort (Institut du Radium, Paris). J. phys. radium 17, 164-5(1956) Feb. (In French)

9437
PHYSICS OF FULLY IONIZED GASES. Lyman Spitzer, Jr. New York, Interscience Publishers, Inc., 1956. 105p.

A theoretical analysis of the behavior of a gas composed of electrons and bare nuclei is given. Motion of a particle, macroscopic motion, waves in a plasma, encounters between charged particles and the Boltzman equation are discussed. (F.S.)

9438
FIELD IONIZATION OF GASES AT A METAL SURFACE AND THE RESOLUTION OF THE FIELD ION MICROSCOPE. Erwin W. Müller and Kanwar Bahadur (Pennsylvania State Univ., University Park). Phys. Rev. 102, 624-31(1956) May 1.

The mechanism of field emission of positive ions is considered as depending upon the supply of molecules and their ionization probability in a field up to 500 million volts/cm. Experimental current-field characteristics match the theoretical curves. The velocity distribution, measured in a retarding potential tube, shows that the ions originate some 5 to 100 A above the surface, depending upon the field. A simple mass spectrometer is described which uses the field emitter as a point ion source. The resolution of the field ion microscope is found to depend upon tip radius, polarizability and ionization potential of the gas, and possibly upon the accommodation coefficient and the temperature. Helium seems to give the best resolution of about 4 A. The possibility of operating a field desorption microscope with sufficient resolution to show the lattice structure of the surface is discussed. (auth)

9439
STRUCTURE OF SHOCK WAVES IN POLYATOMIC GASES. Wayland Griffith, David Brickl, and Vernon Blackman (Palmer Physical Lab., Princeton, N. J.). Phys. Rev. 102, 1209-16(1956) June 1.

This paper describes the results of experiments using a shock tube and interferometer to study the role of vibrational relaxation in shock structure. Shocks of Mach number up to 5 have been observed in air, A, N_2, CH_4, OO_2, N_2O, and CCl_2F_2. In air and nitrogen below about $M_1 = 2$ and in argon the validity of the Rankine-Hugoniot relation using constant specific heat has been established within experimental accuracy. Above $M_1 = 2$ in both air and N_2, the observed density corresponds to only partial equilibrium, no appreciable excitation of vibrational modes occurring, for example, for at least 150μsec at 900°K. Both CH_4 and CCl_2F_2 show fast adjustment with relaxation times less than 1μsec to the expected final state. In CO_2 and N_2O, vibrational relaxation times are observed to be in reasonable agreement with published data. The down-stream state, however, is at a lower density than required for complete equilibrium and the possibility of separate relaxation times for each vibrational mode is suggested; the valence vibrations adjust at least 100 times more slowly than do the bending modes. Added traces of water vapor reduce the visible adjustment greatly but leave the final state unaltered. The catalytic effect of water vapor in speeding equilibration seems therefore to be limited to the bending modes. (auth)

9440
THE THERMAL CONDUCTIVITY OF ARGON BETWEEN 0°C AND 75°C AT PRESSURES UP TO 2500 ATMOSPHERES. A. Michels, A. Botzen, A. S. Friedman, and J. V. Sengers. Physica 22, 121-8(1956) Feb.

The thermal conductivity of argon has been measured with the parallel plate-method at temperatures between 0 and 75°C and at pressures up to 2500 atm. The results are compared with the values calculated from Enskog's formulae for dense gases. (auth)

9441
GENERALISED RELATIONS FOR THE THERMAL DIFFUSION FACTOR OF INERT GAS MIXTURES WITH ONE INVARIABLE CONSTITUENT. B. N. Srivastava and S. C. Saxena (Indian Association for the Cultivation of Science, Calcutta). Physica 22, 253-62(1956) Apr.

The variation of the thermal diffusion factor α for binary mixtures of inert gases, when one constituent is kept fixed and the other varied, has been investigated and semi-empirical formulae have been derived for the variation of α with the proportionate mass difference of the molecules. These results have been explained in terms of the Chapman-Enskog formula for the case of Lennard-Jones 12:6 model, by utilising the experimentally obtained unique dependence of the force constants ϵ_{ij} and r_{ij} on the molecular mass of the variable constituent for a given series of mixtures. The same considerations have been applied to isotopes of monatomic molecules and suitable formulae have been deduced for α, ϵ_{11} and r_{11}. The formulae have been tested by calculating the force constants of radon. (auth)

9442
DIFFUSION COEFFICIENT OF PARTICLES IN A MAGNETIZED INTERSTELLAR MEDIUM. A. A. Logunov and Ia P. Terletskii (Moscow State Univ.). Soviet Phys. JETP 2, 353-4(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 701-2(1955) Feb. (In Russian)

The mechanism of passage of charged particles through a magnetized interstellar medium is discussed. The diffusion coefficient of particles in such a medium is calculated. (B.J.H.)

9443
ADIABATIC PROCESS AT HIGH TEMPERATURES. I. L. Aptekar and B. L. Timan (Cneperpetrovsk Mining Inst.). Soviet Phys. JETP 2, 327-9(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 758-9(1955) June. (In Russian)

In connection with the effect of thermal ionization on the thermal properties of gases at high temperatures, a calculation is made of an adiabatic process taking thermal ionization into account. (B.J.H.)

9444
THE FORMATION OF NEGATIVE OXYGEN IONS IN THE COLLISIONS OF POSITIVE OXYGEN IONS WITH GAS MOLECULES. Ia. M. Fogel and L. I. Krupnik (Physico-technical Inst. of Ikrainian Academy of Sciences). Soviet Phys. JETP 2, 252-61(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 209-20(1955) Aug. (In Russian)

Using a double mass-spectrometer a study was made of the capture of two electrons by positive atomic and molecular ions of oxygen in collisions with molecules of hydrogen, oxygen and nitrogen. The effective cross sections for these processes were measured for oxygen ions with energies between 14 and 41 kev. (auth)

9445
PHENOMENA IN THE VICINITY OF DETONATION FORMATION IN A GAS. K. I. Shchelkin (Institute of Chemical Physics). Soviet Phys. JETP 2, 296-300(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 221-6(1955) Aug. (In Russian)

Phenomena in the vicinity of a detonation are discussed. It is shown in particular that in accordance with a previously developed theory explaining how slow burning combustion turns into a detonation, a detonation can occur in gas both at some distance in front of the slow combustion as well as in its immediate vicinity. (auth)

Refer also to abstracts 9191 and 9261.

INSTRUMENTS

9446 HW-40962
Hanford Atomic Products Operation, Richland, Wash.
POLAROGRAPHY· AN INTERMEDIATE SCANNING RATE POLAROGRAPH C E. Michelson. Dec 21, 1955. 30p. Contract W-31-109-Eng-52. $0.25(OTS).

Scanning rates of 0.02 to 0.4 volts per second were successfully recorded on a Sargent Model XXI polarograph. Substitutions in balance and chart motors and connection of an external bridge circuit were necessary; however, the equipment and circuitry remained basically standard and simple. The synchronization of the drop and scan is accomplished by virtue of the type of bridge employed and requires no additional components. Special large bore electrode terminations were examined with regard to their application at intermediate scanning rates and found to be reproducible and to produce linear calibration curves. The precisions obtained were about the same as those quoted in the literature for oscillographic techniques; however, the equipment is simpler in operation and maintenance. (auth)

9447 AEC-tr-2403
PNEUMATIC PRECISION MEASURING APPARATUS. K. G. Neuss. Translated from Werkstatt. u. Maschinenbau 42: 140-5(1952). 20p.

A measuring device employing precisely controlled compressed air and a manometer column connected through a pressure head to a measuring nozzle is described. It may be used to measure gaps, simple drillings, internal tapers, cylindrical parts, thicknesses, etc. Application as a pneumatic gage, multiple measurements device and modifications for special purposes are discussed. (T.R.H.)

9448 AEC-tr-2557
ULTRAVIOLET METALLOGRAPHIC MICROSCOPE. T. G. Porokhova. Translated from Zavodskaya Lab. 336-40(1956). 14p.

The instrument allows the photography of metallographic sections with ultraviolet waves of various lengths in the visible part of the spectrum, and also their visual observation on a fluorescent screen in the spectral area with wave lengths not shorter than 313 mμ. (W.L.H.)

9449
THE ISOGRAPH—AN ELECTRONIC ROOT FINDER. A. K. Choudhury (Calcutta Univ.). Indian J. Phys. 29, 468-73 (1955) Oct.

The paper describes an electronic isograph for finding the roots of high degree polynomials. The harmonic generator used is a purely electronic device without any moving parts. The different harmonic components are generated with the help of a delay line, fed from a matched frequency-sweep generator. By controlling the amount of frequency sweep of the oscillator any desired interval of the argument can be expanded, thus enabling accurate determination of the argument of the root. (auth)

9450
THE "HARD-BOTTOMING" TECHNIQUE IN NUCLEAR INSTRUMENTATION CIRCUIT DESIGN. C. C. Harris (Oak Ridge National Lab., Tenn.). I.R.E. Trans. Nuclear Sci. NS-3, No. 2, 5-8(1956) Mar.

In operating vacuum tubes so that over-all circuit operation is essentially independent of large tube characteristic changes, "hard bottoming" of vacuum tubes obtains unchanged operation until the tubes are almost inoperative. This principle has been applied to scaling and timing circuits. (F.S.)

9451
ELECTRONIC ANALOG DEVICES FOR DESIGN OF REACTOR CONTROLS. E. R. Mann (Oak Ridge National Lab., Tenn.). I.R.E. Trans. Nuclear Sci. NS-3, No. 2, 12-17(1956) Mar.

Nuclear reactors for power production require essentially two control regimes—one for startup and the other about design point power. The startup regime requires controls and instrumentation for neutron flux. The power regime is one in which temperatures must be controlled. The Bell-Strauss simulator has been used successfully for development of neutron flux control equipment. Nuclear power plant simulation requires a more elaborate analog computer such as the present ORNL nuclear plant simulator. This computer has been used successfully for designing servo mechanisms for rod control, temperature regulation and heat dump control for power reactor designs. Some of these applications are described. (auth)

9452
AN IMPUT AMPLIFIER FOR A PULSE-HEIGHT ANALYSER. A. Folkierski (Imperial Coll. of Science and Technology, London). J. Sci. Instr. 33, 187-91(1956) May.

An instrument was developed to meet specific requirements in the study of γ-ray spectra, with the use of a 50-channel pulse-height analyser. The analyzer can be gated by pulses occurring simultaneously with the pulses to be measured. The scale can be expanded. Errors introduced by the gate do not exceed 1% of the maximum output pulse-height. (F.S.)

9453
A REMOTE CONTROL APPARATUS FOR THE MOVEMENT OF DOSAGE MEASURING OF SIMILAR EQUIPMENT TO INDICATED POSITIONS. B. J. Perry and N. H. Pierce (Westminster Hospital, London). J. Sci. Instr. 33, 191-3 (1956) May.

The mechanical and electrical features of this apparatus are described, with particular reference to ease and cost of construction. The relation of mechanical and electrical backlash to the accuracy of the whole system is discussed, and it is shown that some electrical backlash is essential in this simple type of servo system. Its relation to position setting backlash and minimum inching distance is indicated. (auth)

ISOTOPES

9454
ENRICHMENT OF HEAVY WATER BY A BIOLOGICAL METHOD. John Webb (Coll. of Technology, Belfast). Nature 177, 988-9(1956) May 26.

ISOTOPE SEPARATION

9455 CEA-305
France. Commissariat à L'Énergie Atomique, Paris.
PRODUCTION DE FAISCEAUX INTENSES D'IONS METALLIQUES EN VUE DE LA SEPARATION DES ISOTOPES. (Production of Intense Beams of Metallic Ions With the Object of the Separation of Isotopes.) J. L. Sarrouy. 1955. 110p.

A discussion of the production of intense ion beams includes general descriptions of the research apparatus, the ion source, the ionic optics, methods of measuring the ion current, and the neutralization of the space charge of the beam. Discussions of metallic ion beams include descriptions of the general conditions for obtaining metallic ion beams and experiments made on metals such as Cd, Zn, Mg, Li, Ca, Pb, In, Au, and Cr. (B.J.H.)

MASS SPECTROGRAPHY

9456
MASS SPECTROMETER RESEARCHES. G. P. Barnard. London, Her Majesty's Stationery Office, 1956. 64p. $0.90.

Experimental research with mass spectrometers is summarized. Detailed designs are included for a sector-

field mass spectrometer and for ion sources of the electron bombardment type for single-focusing mass spectrometers. Experimental studies of ion source behavior are also discussed. (B.J.H.)

Refer also to abstracts 9143 and 9189.

MEASURING INSTRUMENTS AND TECHNIQUES

9457 AERE-EL/R-1997
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN INTERIM REPORT ON RADIAC CONTAMINATION METER DEVELOPMENTS. W. Abson and O. H. Turner. June 1956. 14p.

A detailed study was made of the performance of a β-sensitive ionization chamber for monitoring fission product contamination of the skin and clothing. Data are tabulated. Data are included from preliminary studies on the performance of a β-sensitive Geiger counter used for the same purpose. Requirements for a monitor for assessing the β-radiation hazard from ingested radioactive material are also discussed. (C.H.)

9458 CEA-329
France. Commissariat à L'Énergie Atomique, Paris.
LA MESURE DES FAIBLES CHARGES ELECTRIQUES PAR LA TECHNIQUE DES IMPULSIONS—LA SPECTROMETRIE DES RAYONNEMENTS α. (Measurement of Small Electric Charges by the Pulse Technique—Spectrometry of α Rays.) G. Valladas. 1955. 12p.

9459 HW-41184
Hanford Atomic Products Operation, Richland, Wash.
A SCINTILLATION EXPOSURE-RATE METER. W. G. Spear. May 28, 1956. 18p. Contract W-31-109-Eng-52. $0.20(OTS).

A compact, rugged, portable scintillation β-γ exposure-rate meter was designed and fabricated. The instrument employs a multiplier phototube and a thin crushed anthracene crystal weighing 200 mg/cm^2 mounted $\frac{1}{8}$ inch from the phototube face. The crystal is covered with a 15 mg/cm^2 light shield of mylar and opaque tape. The phototube drives a d-c amplifier circuit which in turn activates the meter. The instrument has three ranges: 0-10 mr/hr, 0-100 mr/hr, and 0-1000 mr/hr. The crystal and light shield were made thin to permit good beta response at the lower energies. The device weighs 5$\frac{1}{2}$ pounds. Details of design are included. (auth)

9460 LA-1909
Los Alamos Scientific Lab., N. Mex.
INSTRUMENTS FOR THE MONITORING OF TRITIUM IN THE ATMOSPHERE. B. C. Eutsler, G. L. Evans, R. D. Hiebert, R. N. Mitchell, Chain Robbins, and R. J. Watts. Apr. 1955. 20p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

Three types of instruments, all operating on the same principle, are described. These are a battery operated type, an AC operated linear type, and an AC operated logarithmic type. The current from a conductivity type chamber is monitored by a simple electrometer tube circuit. A warning bell is rung by means of a sensitrol relay when ionization in the atmosphere produces a full scale reading. These instruments are intended for special situations where the environment can be controlled to some extent. They will respond to ionization arising from any source. A full scale reading on the most sensitive scale is equivalent to a current of 10^{-12} amp in the chamber. Curves are given of the behavior of this type of instrument with flow rate, tritium concentration, equilibrium time, voltage ion traps, and tritium in the form of HT and HTO. It is concluded that these instruments are satisfactory as warning devices but are of doubtful value as health tolerance meters. (auth)

9461 NP-5968
Rochester, N. Y. Univ.
CONTROLLED DEVELOPMENT FOR NUCLEAR EMULSIONS. Jacques M. Blum. [1955]. 7p.

A graphical technique is outlined for obtaining a desired and reproducible degree of development for nuclear emulsions. The active phase of development is separated into two or more stages. (C.W.H.)

9462 SCEL-M-1752
Evans Signal Lab., Belmar, N. J.
DOSE-RATE DEPENDENCE OF DOSIMETERS AT DOSE RATES UP TO TWO MILLION ROENTGENS PER HOUR. Marvin N. Stein. Apr. 3, 1955. 43p. DA Project No. 3-99-04-300.

It was determined that the sensitivity of the pocket dosimeters tested was a function of the intensity of the field in which they were exposed. The sensitivity at 2 million r/hr was about 25% less than at dose rates of 10,000 r/hr. Over the same range of dose rates the sensitivity of the ionization chamber itself was found to be independent of the intensity within the experimental accuracy of the measurements. The dose-rate dependence is believed to be due to radiation effects on the capacitor which is a component part of the dosimeter. The radiation effect on the capacitor is twofold. First, photoconductivity within the capacitor has the effect of an auxiliary ionization chamber in parallel with the actual collection chamber producing a greater over-all sensitivity for the instrument. This photoconductive effect is reported to be dose-rate sensitive, but this phenomenon has not yet been studied. Secondly, persistent internal polarization produces erratic behavior of the instrument which is dependent on the previous radiation and treatment of the dosimeter. The dose-rate dependence is believed to be primarily caused by this latter effect, although the mechanism involved has not yet been satisfactorily determined. The back-up effect, that is a gradual decrease in scale reading after exposure, was noted and is also believed to be a result of the internal polarization. (auth)

9463 AERE-Lib/Trans-589
A GAS BUBBLE CHAMBER—A POSSIBLE RECORDER OF THE ELEMENTARY PROCESS OF INTERACTION OF IONISING RADIATION WITH MATTER. G. A. Askar'yan. Translated by J. B. Sykes from Zhur. Eksptl'. i Teoret. Fiz. 28, 636(1955). 2p.

9464
DOSAGE CALCULATIONS FOR ROTATION THERAPY WITH SPECIAL REFERENCE TO COBALT 60. H. E. Johns, M. T. Morrison, and G. F. Whitmore (Univ. of Saskatchewan and Cancer Clinic, Saskatoon, Canada). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1105-16(1956) June.

The use of tumor-air ratios makes it as easy to determine accurately the tumor dose during rotation therapy as it is to determine the tumor dose during fixed field therapy. Once a complete distribution for an average patient has indicated the suitability of rotation, then it should not be normally necessary to determine the dose at points other than the tumor center. However, if the dose at some other point is required in a particular case, then the method outlined above may be used to find it. (auth)

9465
A METHOD FOR MONITORING BACKGROUND BY MEANS OF A STATISTICAL CONTROL CHART. Eugene L. Saenger and Charles M. Herbert (Brooke Army Hospital, Fort Sam Houston, Texas). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1174-6(1956) June.

A simple control chart for the recording and interpretation

of routine background counts in the radioisotope laboratory is described. Such a chart has been found useful in the control of error of counting techniques and improves accuracy and confidence in measurement of radioisotopes. (auth)

9466

AN EXPERIMENT DESIGNED TO TEST THE VALIDITY OF THE CURRENT PRACTICE OF USING SINGLE EXPOSURE DATA TO CALCULATE MAXIMUM PERMISSIBLE CONCENTRATION IN WATER FOR CONTINUOUS EXPOSURE TO RADIOISOTOPES. Mary Jane Cook and Karl Z. Morgan (Oak Ridge National Lab., Tenn.) and Arthur G. Barkow (Marquette Univ., Milwaukee). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 1177-87(1956) June.

9467

LOW PRESSURE DIFFUSION CLOUD CHAMBER TRACKS OF FRAGMENTS FROM THE SPONTANEOUS FISSION OF CALIFORNIUM 252. I. Hilding Slatis. Arkiv Fysik 10, No. 5, 479-88(1956).

The development of the diffusion cloud chamber is briefly given. A diffusion cloud chamber for demonstration purposes and a low pressure diffusion chamber have been constructed. Tracks of α particles and fission fragments from Cf^{252} and electrons and protons are shown, the first two types of tracks at a pressure of 0.2 atmospheres. (auth)

9468

THE PRODUCTION OF TRANSPARENT PROFILES OF DUST PARTICLES AS AN AID TO AUTOMATIZED PARTICLE COUNTING. R. J. Hamilton and B. A. Phelps (Mining Research Establishment, Isleworth, Middlesex, England). Brit. J. Appl. Phys. 7, 186-8(1956) May.

The technique of "shadowing" by metal evaporation in a vacuum has been adapted to the production of plane "negative" images of dust deposits on microscope slides at natural size by vacuum evaporation of metal at right angles to the slide, and subsequent removal of the dust. The slide receives a precise impression of the geometric projections of the particles. The correspondence of image and object is exact. The thickness of the deposited film can be suited to the contrast requirements of an automatic particle counter; further, the film lies in one plane and is only a few hundred ångström units thick. Many of the optical problems arising from the association of automatic counting techniques with high power light microscopy, namely, depth of focus and variable contrast between particles and background and between different parts of single particles, are avoided by substituting the shadow for the original specimen. (auth)

9469

MEASUREMENT OF THE HALF-LIFE OF RADON WITH A CURIE-TYPE IONIZATION CHAMBER. P. C. Marin (Clarendon Lab., Oxford, England). Brit. J. Appl. Phys. 7, 188-90(1956) May.

An improved version of the Curie-type ionization chamber enables an accurate comparison to be made of the ionization currents produced by γ rays. The ionization current produced by 1 mc of radium can be measured with an accuracy of 0.02%. The linearity of response of this instrument has been investigated for radon sources up to 250 mc, with an argon gas filling. The half life of radon measured in this way was found to be 3.8229 ± 0.00027 days. (auth)

9470

A SCINTILLATION DOSE-RATE METER USING A TUNED LOW-FREQUENCY AMPLIFIER. R. J. T. Herbert (Liverpool Radium Inst., England). Brit. J. Radiol. 29, 345-9 (1956) June.

9471

THE BACK-SCATTER CORRECTION FOR BETA-RAY CHAMBERS. J. L. Haybittle (Addenbrooke's Hospital, Cambridge, England). Brit. J. Radiol. 29, 349-51(1956) June.

9472

THE LOCALISATION OF POINT SOURCES OF RADIOACTIVITY IN ABSORBING MEDIA. J. Rundo (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Radiol. 29, 352(1956) June.

9473

ANALYSIS OF SPURIOUSNESS OF GEIGER-MULLER TUBES AT HIGH TEMPERATURES. Satya Pal Puri and P. S. Gill (Muslim Univ., Aligarh). Indian J. Phys. 30, 1-9(1956) Jan.

This is a sequel to the earlier report by the authors regarding the temperature-dependence of spurious discharges in G-M counters. A quantitative confirmation of the conclusions arrived at therein, is obtained by studying the time-distribution of pulses at higher temperatures by the method of delayed coincidence. The results of the present investigation indicate that: the dead and transit times remain constant with temperatures; the coefficient of secondary emission remains constant in the case of internal counters, whereas there is an exponential increase in its value in the case of Maze type of counter; the high counting rate decays with the time of heating and the curve is analogous to that of the desorption of the quenching vapor. These observations are discussed in light of possible mechanisms and it is inferred that desorption of the vapor at high temperatures is the cause of temperature effect. The mechanism of emission of the adsorbed vapor is not clear. (auth)

9474

THE TEMPERATURE-DEPENDENCE OF G-M COUNTER CHARACTERISTICS. PART I. Satya Pal Puri and P. S. Gill (Muslim Univ., Aligarh). Indian J. Phys. 30, 62-9(1956) Feb.

A study of the characteristics of a self-quenching argon-petroleum ether internal and an argon-alcohol filled external counter was carried out in the range of 16 to -20°C. The internal counter is found to be independent of temperature in the above mentioned range of temperature. The changes of the characteristics of the argon-alcohol filled external cathode counter are ascribed to the condensation of the alcohol content. This counter is temperature-independent up to –7°C. The threshold voltage falls by about 100 volts at -11.5°C and decreases by further lowering the temperature. The operation remains the same down to a few degrees lower than the saturation temperature. Beyond –11.5°C, the electrical resistance of the glass envelope becomes too high to allow this type of counter to operate satisfactorily. (auth)

9475

THE TEMPERATURE-DEPENDENCE OF G-M COUNTER CHARACTERISTICS. PART II. Satya Pal Puri and P. S. Gill (Muslim Univ., Aligarh). Indian J. Phys. 30, 70-9(1956) Feb.

The measurements were made on self-quenching argon-petroleum ether, argon-butane, and argone-alcohol filled Geiger-Muller counters in the range of 32 to 150°C, 34 to 100°C, and 27 to 138°C respectively. The results indicate a progressive rise of the threshold as the temperature is increased, substantial temperature-independence, up to 80°C, 55°C, and 105°C respectively, an exponential increase in slope with temperature and decrease in overall width of the plateau characteristics at higher temperatures, a large increase in counting rate at high temperatures, and a sudden deterioration at 100, 85, and 105°C, respectively. It is inferred that it is the desorption of the quenching vapor at higher temperatures, which causes the rise of the threshold. The increase in counting rate with temperature may be due to the formation of negative ions of the absorbed gas at the cathode. (auth)

9476

A TIME OF FLIGHT NEUTRON VELOCITY SELECTOR

USING SCINTILLATION COUNTER. A. P. Patro (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 30, 99-105 (1956) Mar.

A method of selecting neutrons of different energies in the range 1 to 30 kev is described. The method utilizes scintillation counters for the detection of neutrons, and neutron energies are measured from the time elapsing in its travel from one scintillating phosphor to a second phosphor. It is shown that the method is capable of greater resolution than the usual time of flight methods and various improvements are suggested. Measurements of transmission curves ($\sim \sigma_t$) have been made in the above energy range for V, Mn, and Bi. The evidence of resonances for these elements is found and discussed. (auth)

9477

MAGNETIC SPECTROGRAPH WITH PRE-ACCELERATION FOR THE STUDY OF LOW ENERGY ELECTRONS. Salomon Rosenblum, Jose Sant'ana Dionisio, and Manuel Valadares. J. phys. radium 17, 112-16(1956) Feb. (In French)

Descriptions are given of a 180° magnetic spectrometer utilizing an electric device to permit electron acceleration in the neighborhood of the source. The application of this method to the detection of low-energy electrons in photographic emulsion is discussed, and results obtained with sources of Rn^{220} and Am^{241} are presented. (tr-auth)

9478

MEASUREMENT OF THE GRAIN DIMENSIONS OF NUCLEAR EMULSIONS BY THE ENVELOPE METHOD. Christiane Gegauff and Jacqueline Boissier. J. phys. radium 17, 162-3(1956) Feb. (In French)

9479

DRYING OF PHOTOGRAPHIC NUCLEAR EMULSIONS BY THE TEMPERATURE GRADIENT. Roger Rechenmann. J. phys. radium 17, 163-4(1956) Feb. (In French)

9480

ABSOLUTE MEASUREMENT OF β-EMITTING RADIOELEMENTS BY THE METHOD OF THE DEFINITE SOLID ANGLE. B. Grinberg and Y. Le Gallic. J. phys. radium 17, phys. appl. suppl., 35A-40A(1956) Mar. (In French)

The definite solid angle method was modified in order to eliminate most of its difficulties. Also, a method was developed for determining the fraction of transmitted radiation. This method was used as much for measurements on pure β emitters (P^{32}, S^{35}) as for β-γ emitters (Co^{60}, I^{131}, and Na^{24}). Determinations made using this method are in good agreement with those made by other methods. (tr-auth)

9481

THE MEASUREMENT OF ALPHA ACTIVITIES OF INDIAN ROCKS AND MINERALS USING PROPORTIONAL COUNTER. V. Seetharam Aithal (Indian Inst. of Science, Bangalore). J. Sci. Ind. Research (India) 15B, 204-5(1956) Apr.

9482

AN OXYGEN-QUENCHED GEIGER-MÜLLER COUNTER. D. Srdoč (Ruder Bošković Inst., Zagreb, Yugoslavia). J. Sci. Instr. 33, 185-6(1956) May.

Systematic investigations have been made to determine the best concentrations of mixtures of neon, argon and oxygen for filling self-quenching Geiger-Müller counters. Evidence is given of the quenching action of oxygen in mixtures with neon and argon. The life of such counters seems to be unlimited. A plateau 65 v wide with a 15% slope per 100 v has been obtained at v_{op} = 400 v. Cathodes of various materials have been used and it was found that copper, brass and aluminium, coated with colloidal graphite, are quite satisfactory. This is an advantage relating to halogen-quenched Geiger-Müller counters. (auth)

9483

A PROPORTIONAL COUNTER TUBE FOR X-RAY DIFFRACTION ANALYSIS. A. R. B. Skertchly (Univ. of Leeds). J. Sci. Instr. 33, 209-10(1956) June.

An argon-filled, ethyl alcohol quenched counter utilizing a diagonal radiation absorption path is described. The quantum efficiency is 67% when detecting CuKα quanta. When it is used in conjunction with a single-channel pulse amplitude analyzer operating with a bandwidth of 3.6 v centered at 30 v its overall efficiency is 46%. Little distortion is introduced into the pulse height distribution curve owing to the incomplete dissipation of the energy of the photoelectrons, and the required low capacitance for high signal-to-noise ratios at low operating potentials is preserved. (auth)

9484

A CALORIMETRIC METHOD OF DETERMINING THE ENERGY OUTPUT OF RADIOACTIVE MATERIALS. A. G. White (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 33, 230-4(1956) June.

A method of making a direct measurement of the rate of change of temperature with time is described. To do this a large capacity condenser and galvanometer are used in a circuit containing a thermistor as the temperature sensitive element. A description of two calorimeters embodying this principle, with which the energy outputs of radioactive samples may be determined, is given. The theoretical basis of the method is examined and means of estimating correction terms are suggested. (auth)

9485

A SIMPLE VISUAL METHOD OF ACCURATELY POSITIONING A SPECIMEN RELATIVE TO AN X-RAY BEAM. P. J. Holmes and P. D. Fochs (Associated Electrical Industries Ltd., Aldermaston, Berks, England). J. Sci. Instr. 33, 239 (1956) June.

9486

A PROCEDURE FOR THE QUANTITATIVE DETECTION OF LOW ENERGY β-RADIATION WITH FLUORESCENT SOLUTIONS. Jean C. Roucayrol and Erich Oberhausen. Naturwissenschaften 42, 411-12(1955) July. (In German)

9487

THE CONTRIBUTION OF NEUTRONS TO THE BACKGROUND OF COUNTERS USED FOR ^{14}C AGE MEASUREMENTS. Hl. De Vries (Univ. of Groningen). Nuclear Phys. 1, 477-9(1956) May.

Evidence is given that neutrons produced by cosmic radiation produce an important fraction of the residual background of counters used for C^{14} age measurements. Neutron monitoring is essential in order to check irregular variations of the neutron flux, as for instance produced by solar flares. During the solar flare of Feb. 23 the average background for the whole night was 2.5 times normal. (auth)

9488

THREE WAYS TO INCREASE EFFICIENCY OF LIQUID SCINTILLATORS. C. A. Ziegler, H. H. Seliger, and I. Jaffe (National Bureau of Standards, Washington, D. C.). Nucleonics 14, No. 5, 84-6(1956) May.

Methods of increasing the effective light output of p-terphenyl in xylene and 2,5-diphenyl-oxazole in xylene scintillating solutions were investigated. These include removal of O and other gases present, addition of the wavelength shifter, α-napthylphenyl oxazole, and reduction in temperature. Results are presented in graphical form. (B.J.H.)

9489

ALPHA-SPECTRA ION CHAMBERS. U. Facchini and A. Malvicine (Laboratori CISE, Milan, Italy). Nucleonics 14, No. 5, 96(1956) May.

Brief descriptions are given of two ionization chambers which provide simple and rapid detection of α-particle

spectra. The operation of the counters is also briefly described. (B.J.H.)

9490

A WINDOWLESS FLOW COUNTER FOR PAPER STRIPS. John M. Lowenstein and Phillip P. Cohen (Univ. of Wisconsin, Madison). Nucleonics 14, No. 5, 98-100(1956) May.

A windowless flow counter was constructed in order to count paper strips with greater sensitivity than was possible with thin-window G-M tubes. The apparatus consists essentially of a paper feeding mechanism and a gas flow tube which is mounted over a paper-guide channel. (B.J.H.)

9491

IMPROVED FALLOUT METER USING CdS. Lawrence Ruby (Univ. of California, Berkeley). Nucleonics 14, No. 5, 101 (1956) May.

Modifications are described which eliminate the disadvantages in the CdS dose-rate meter. (B.J.H.)

9492

MEASUREMENT OF ACTIVITY OF COMPOUNDS TRACED WITH LOW-ENERGY BETA EMITTERS. Jean C. Roucayrol and Erich Oberhausen. Science 122, 201-2(1955) July 29.

9493

PULSED GEIGER COUNTERS. Anton B. Witzel (Admiral Corp., Chicago). I.R.E. Trans. Nuclear Sci. NS-3, No. 1, 2-9(1956) Feb.

Two portable instruments for measuring gamma radiations were developed and are discussed. The AN/PDR-4 weighs about 2 lbs, occupies a volume of about 50 $in.^3$, has an over-all accuracy of ± 20% in the temperature range −20 to +50°C and is capable of 20 hrs operation. The MG-1 airborne radiation detector weighs 2½ lbs, is 8 in. long, hermetically sealed in an aircraft case, and operates in a temperature range from −54 to +71°C. (F. S.)

9494

A DUAL FUNCTION GAMMA MONITOR. R. E. Connally (Hanford Atomic Products Operation, Richland, Wash.). I.R.E. Trans. Nuclear Sci. NS-3, No. 2, 28-31(1956) Mar.

A thallium-activated sodium iodide gamma monitor is described which utilizes both the ac and dc components of the anode current of a multiplier phototube. The dc component serves to monitor over a range of 10^4 the gross gamma activity of selected points in a solvent extraction plant for the processing of spent nuclear fuel. From the ac component a gamma energy analysis is obtained over an activity range of 10^2. The ac component also serves as a monitor on the multiplier phototube gain adjustment. The characteristics of the gamma monitor system are discussed. (auth)

Refer also to abstract 9705.

MESONS

9495 HEPL-100

Stanford Univ., Calif. High Energy Physics Lab. LITERATURE ON THE PHOTOPRODUCTION OF PIONS. Carol M. Newton. July 1956. 22p. Linear Electron Accelerator Project. Contract N6onr-25116.

9496 AEC-tr-2412

AN EFFECTIVE POTENTIAL FOR THE PION-NUCLEON INTERACTION. V. R. Velibekov and V. A. Meshcheryakov. Translated from Doklady Akad. Nauk S.S.S.R. 105, 951-4 (1955). 4p. Available from Consultants Bureau, New York.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-5880. (C.H.)

9497 AERE-Lib/Trans-636

THE PROBABILITY OF FISSION OF URANIUM NUCLEI ON CAPTURING SLOW π^--MESONS. O. V. Lozhkin and V. P. Shamov. Translated by V. Beak from Zhur. Eksptl'. i Teoret. Fiz. 28, 739-40(1955). 3p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-6739.

9498

PHOTO-ELECTRIC MASS DETERMINATIONS IN NUCLEAR EMULSIONS. PART IV. DETERMINATIONS OF K-PARTICLE MASSES. Krister Kristiansson. Arkiv Fysik 10, No. 5, 447-65(1956).

Photo-metric measurements of the mass of K particles stopping in nuclear emulsions are described. The paper discusses the method of measurement and the errors which normally appear in such mass measurements. The errors are eliminated as far as possible by accurate checking of the instrument and a suitable choice of the tracks used for comparison. The result of the mass measurements of six K particles is 975 ± 23 m_e, in good agreement with other mass determinations. (auth)

9499

CLASSIFICATION OF HYPERONS AND HEAVY MESONS. M. Markov (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 106, 814-17(1956) Feb. 11. (In Russian)

Classification of new particles is discussed in which Gellman expresses the charged number of θ/e particles (the components of charging multiple) as $\theta/e = I_z + n/2 + S/2$, where I_z is the particle isotopic spin component; n is the number of particles minus the number of anti-particles (nucleons and hyperons). A certain "special" quantum number S is ascribed to nucleons, hyperons, and mesons (bosons). For protons (P) neutrons (n), and π mesons S = 0; for Λ°, and Σ the S = −1; for K°, and K^+ S = + 1; and, for cascade hyperons Ξ, Ξ° S = −2. For antiparticles, S changes the sign (K^-, $\tilde{K}^\circ$ are also for antiparticles). S is retained for strong, electromagnetic interactions but it is eliminated in weak interactions ($\Lambda^\circ \rightarrow p + \pi^-$). For variations of the number S there is established a rule: $\Delta S = \pm 1$. The number S preserved for strong and electromagnetic interactions results in relative stability of hyperons and heavy mesons, and in strong interactions hyperons are formed in a pair where the particle possesses S, equal to hyperon S but with a negative sign. The study indicates that the opinion previously expressed by the author about the nature of hyperons and K mesons coincides with Gellman theory and the number S acquires specific physical interpretations. Hyperons are considered as nucleons in an excited state. Mathematical illustration of similar excitations may be made from an oscillation-type model. The number of hyperons in an excited state coincides with the number S(S = 0,1,2). The rule of selecting $\Delta S = \pm 1$ applies only for the transitions between the adjacent excitations. (R.V.J.)

9500

ON THE IMPOSSIBILITY OF ACCOUNTING FOR THE STABILITY OF HYPERONS BY THEIR LARGE SPIN. I. I. Gurevich. Doklady Akad. Nauk S.S.S.R. 107, 41-2(1956) Mar. 1. (In Russian)

9501

PRIMARY IONIZATION SPECTRUM OF FAST μ MESONS. G. P. Eliseev, V. A. Lyubimov, and A. M. Frolov Doklady Akad. Nauk S.S.S.R. 107, 233-5(1956) Mar. 11. (In Russian)

The theory of logarithmic order of increase in primary ionization with the increased velocity of the charged particle passing through primary ionization media and the effects of media polarization caused by the passage of high-energy charged particles are analyzed. Spectra were obtained for the primary ionization of fast μ mesons in the energy interval of 2×10^8 to 3.4×10^{10} ev/c. The energy of the

particle was measured by its trajectory curve in the magnetic field of a mass spectrograph. The ionization was measured by two 10-layer, low-efficiency counters, filled with neon and propane mixture under 30 mm pressure. Each counter layer was of equivalent efficiency, thus, it may be considered as one 20-layer counter. Ionizations and energies of 1779 μ mesons were measured; all particles were divided into 10 groups according to their energies and the mean energy and ionization for each group was determined. Results of experiments concur with the theory of primary ionization logarithmic order of increase induced by relativistic particles and the theory of primary ionization saturation effected by polarization of the media for μ mesons with energies of $p > 10^{10}$ ev/c was confirmed. (R.V.J.)

9502

SCATTERING OF NEGATIVE MESONS IN HYDROGEN. INVESTIGATIONS IN DIFFUSION CHAMBERS. M. Kozodaev, R. Sulyaev, A. Filippov and Yu. Shcherbakov (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 107, 236-9(1956) Mar. 11. (In Russian)

A diffusion chamber 270 mm in diameter filled with hydrogen under 200 atm pressure was used in studies of interactions of π mesons at an energy of 330 Mev with protons: $\pi + p \rightarrow \pi^- + p$ (elastic scattering); $\pi^- + p \rightarrow \pi^\circ + n$ (scattering with recharge); $\pi^- + p \rightarrow \pi^\circ + \gamma$; and the interaction followed by meson formations. The work was limited to the measurements of the total cross section of elastic scattering and scattering with recharge. The results showed that with π^--meson energy of 330 Mev the cross section ratio is σ recharge/σ elast. = 1.2 ± 0.5. With smaller energies of π mesons, with the area of maximum cross sections, the ratio is equal to 2. Using the hypothesis of nuclear forces charge independence it was concluded that the variations observed in the ratio of σ recharge/σ elastic indicate that with π-meson energies of 330 Mev, there is no prevailing interaction with isotopic spin $T = 3/2$ and the interactions with isotopic spin $T = 3/2$ and $T = 1/2$, at the above energy, are equally important. An analogous conclusion was obtained in comparison of total cross sections of positive and negative meson scattering on protons at the same energies. (R.V.J.)

9503

MUONIC INTERACTIONS IN DENSE MATERIAL. M. M. Biswas (Presidency Coll., Calcutta). Indian J. Phys. 29, 490-500(1955) Oct.

The production of penetrating particles by fast μ mesons interacting with lead placed above a cloud chamber and the formation of stars in the lead plate inside the chamber have been investigated. The cross section for the formation of penetrating particles is of the order of $\sim 10^{-30}$ cm^2/nucleon and that for star formation $\sim 10^{-29}$ cm^2/nucleon which are in agreement with the observations of other authors. (auth)

9504

THE DEPENDENCE OF THE COMPOSITE MEAN LIFE OF MU-MESONS ON THE ATOMIC NUMBER OF THE ABSORBER. N. N. Biswas (Bose Inst., Calcutta). Indian J. Phys. 29, 527-33(1955) Nov.

The measurements of the mean life of the composite beam of μ-mesons (both positive and negative) at sea level in absorbers of C, Al, S and Pb have been reported previously. The same experiment has been conducted with water and NaF absorbers. In water (only oxygen is effective, since a hydrogen atom rarely captures a μ-meson), the composite mean life is found to be 1.95 ± 0.08 micro-seconds. Choosing the thickness of water absorber to be equivalent to the sulfur absorber with respect to the stopping power of the μ-mesons, the decay curve of the positives in S has been taken to represent the same in water and hence by subtraction, the mean life of the negative μ-mesons in water has been determined to be equal to 1.80 ± 0.19 microseconds. In the case of NaF ($Z_{eff} = 10.1$) absorber, the experimental points have been found to represent a composite decay curve giving the mean life equal to 1.82 ± 0.09 microseconds. The Z dependence of the composite mean life has been found to fit an empirical relation, $\tau_{\pm} = 2.50 - 0.065\ Z$ microseconds in the interval Z = 6 to Z = 16. (auth)

9505

MESONIC VS NONMESONIC HYPERFRAGMENT DECAY. T. K. Fowler (Univ. of Wisconsin, Madison). Phys. Rev. 102, 844-7(1956) May 1.

An attempt has been made to see whether reabsorption of pions, which would be produced inside a hyperfragment if the bound hyperon decayed as if it were free, might account for the striking decrease, with increasing hyperfragment size, of the number of hyperfragment decays in which a pion is actually observed. Optical-model calculations, as well as experimental yields for the analogous process of photopion production inside nuclei, indicate that much too few pions would be reabsorbed. Another model of hyperfragment decay, in which nucleons may influence the bound hyperon to decay without real pion emission, could be made to fit the data. (auth)

9506

RADIATIVE $\pi - e$ DECAY. Tetsuo Eguchi (Iowa State Coll., Ames). Phys. Rev. 102, 879-81(1956) May 1.

Under the assumption that the pion decay into an electron and a neutrino is forbidden or partially forbidden, the probability for a pion to decay into an electron, a neutrino, and a photon is considered under general assumptions as to the intermediate state. The spectra of the electron energy in this radiative decay are obtained for the various types of the interaction between the particles in the intermediate state and the leptons in the final state. The total probability of the radiative decay is of the order of 10^{-5} per $\pi - \mu$ decay, except in the case of the scalar interaction where both the radiationless and radiative decays are forbidden. (auth)

9507

MEAN LIFETIME OF NEGATIVE K-MESONS. Edwin L. Iloff, Gerson Goldhaber, Sulamith Goldhaber, and Joseph E. Lannutti (Univ. of California, Berkeley) and F. Charles Gilbert, Charles E. Violet, and R. Stephen White (Univ. of California, Berkeley and Livermore) and D. M. Fournet, A. Pevsner, and D. Ritson (Massachusetts Inst. of Tech., Cambridge) and M. Widgoff (Harvard Univ., Cambridge, Mass.). Phys. Rev. 102, 927-8(1956) May 1.

A mean lifetime for K^- mesons was determined by exposing stacks of stripped 600 μ Ilford G-5 emulsions to the K^--meson beam of the bevatron so that the particles entered parallel to the emulsion layers. The plates were scanned independently by 3 groups, and the resultant lifetime is given as $\tau_{k^-} = (0.95^{+0.36}_{-0.25}) \times 10^{-8}$ sec. (B.J.H.)

9508

INTERACTIONS OF K^--MESONS IN NUCLEAR EMULSION. D. M. Fournet (Massachusetts Inst. of Tech., Cambridge) and M. Widgoff (Harvard Univ., Cambridge, Mass.). Phys. Rev. 102, 929-30(1956) May 1.

The mean free path for nuclear interaction of negative K mesons in emulsion was measured and the types of interactions which occur were found to be consistent with the conservation of strangeness. (B.J.H.)

9509

ASSOCIATED PRODUCTION AND THE LIFETIMES OF THE Λ^0 AND θ^0 PARTICLES. H. Blumenfeld, E. T. Booth, and L. M. Lederman (Columbia Univ., New York) and W. Chinowsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 1184-5(1956) May 15.

A preliminary report is presented of observations on

heavy unstable particles in the Columbia 36-in.- diameter magnet cloud chamber at the Brookhaven Cosmotron. Analysis of the tracks gives mean lives of $\tau_{\Lambda^0} = (2.8^{+0.5}_{-0.4}) \times 10^{-10}$ sec and $\tau_{\theta^0} = (0.8^{+0.3}_{-0.2}) \times 10^{-10}$ sec. (B.J.H.)

9510
RATIOS OF DECAY MODES OF K^+ MESONS PRODUCED BY THE COSMOTRON. T. F. Hoang, M. F. Kaplon, and G. Yekutieli (Univ. of Rochester, N. Y.). Phys. Rev. 102, 1185-7(1956) May 15.

A stack of Ilford G-5 stripped emulsions was exposed to the K^+-meson beam of the Brookhaven Cosmotron. The resultant branching ratios for K^+ decay modes are tabulated. (B.J.H.)

9511
DECAY MODES OF NEGATIVE K-MESONS. A Gösta Ekspong and Gerson Goldhaber (Univ. of California, Berkeley). Phys. Rev. 102, 1187-8(1956) May 15.

Four K^- meson decays in flight were observed in nuclear emulsions, and the events are analyzed in some detail. (B.J.H.)

9512
NOTE ON SUBSEQUENT TRANSITIONS IN MESON-ATOMS. M. I. Podgoretskii (P. N. Lebedev Inst. of Phys.). Soviet Phys. JETP 2, 363-4(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 374-5(1955) Sept. (In Russian)

The correlation between meson spin and the angular correlations of γ quanta emitted during transitions in meson atoms is briefly considered. (B.J.H.)

Refer also to abstracts 9403, 9410, 9633, 9656, and 9659.

MOLECULAR PROPERTIES

9513
MEASUREMENT OF "OPTICAL" TRANSITION PROBABILITIES OF Cd. J. P. A. Van Hengstum and J. A. Smit. Physica 22, 86-98(1956) Feb.

Of 31 level combinations in the Cd atom the probability of spontaneous transition was found with the aid of the spectrum of an arc discharge between carbon electrodes in air with Cd vapor. For that purpose the intensities of the Cd lines were measured on the one side, while on the other side the populations of the upper levels of those lines were calculated from the simultaneously measured arc temperature. The temperature was derived from intensity ratios in the CN bands also occurring in the arc spectrum. The measurements are only relative; since, however, of one line the absolute value of the transition probability was known by other methods the relative results could be converted into absolute values. The results are summarized. Checking measurements showed the absence of disturbing self-absorption etc., and confirmed the validity of Boltzmann's formula for the level populations in the used dc and ac arcs. (auth)

NEUTRONS

9514 ORNL-2107
Oak Ridge National Lab., Tenn.
SOME REMARKS ON THE SLOWING DOWN OF NEUTRONS IN HYDROGEN. L. C. Biedenharn and T. A. Welton. Aug. 21, 1956. 17p. Contract W-7405-eng-26. $0.20(OTS).

The Goertzel–Selengut approximation of the slowing down of neutrons in H is briefly reviewed and analyzed. It is found that the approximation, which neglects the variation of neutron energy loss with the scattering angle, causes appreciable error in the slowing down length in H. There is some indication that the fission source distribution might possibly be the source of the discrepancy. (B.J.H.)

9515
THERMAL-NEUTRON DIFFUSION LENGTHS FOR WATER, LUCITE, FURFURAL, AND AN EXPANDED PLASTIC. L. R. Heintze (Brookhaven National Lab., Upton, N. Y.). Nucleonics 14, No. 5, 108, 109, & 110-11(1956) May.

A thermal column of the BNL Reactor consisting of a graphite cylinder 9⅞ in. in diameter and 20 in. long was used as a thermal-neutron source to measure the thermal-neutron diffusion lengths for H_2O, lucite, furfural, and an expanded plastic. Results give diffusion lengths of 2.86 ± 0.03, 3.14 ± 0.03, 5.57 ± 0.14, and 6.73 ± 0.21 cm for these materials respectively. (B.J.H.)

9516
THE INELASTIC SCATTERING OF 2.5 MEV NEUTRONS BY CHROMIUM, MANGANESE, AND VANADIUM. L. E. Beghian, D. Hicks, and B. Milman (Clarendon Lab., Oxford, England). Phil. Mag. (8) 1, 261-8(1956) Mar.

Experiments have been carried out on the inelastic scattering of 2.5 Mev neutrons by Cr, Mn, and vanadium. Both γ rays and inelastically scattered neutrons were observed. The following levels were identified: Cr, 1.44 ± 0.03 Mev; Mn, 0.126 ± 0.005 Mev; 0.98 ± 0.05 Mev; 1.34 ± 0.05 Mev; 1.65 ± 0.05 Mev; and 2.40 ± 0.05 Mev; V, 0.32 ± 0.02 Mev; 0.92 ± 0.04 Mev; 1.62 ± 0.04 Mev; and 1.83 ± 0.04 Mev. The decay scheme of the levels excited in Mn^{55} was investigated by the method of γ-γ coincidences, and it was shown that the higher energy states decay by cascade via the 0.126-Mev level. (auth)

9517
TOTAL CROSS SECTIONS OF LIGHT ELEMENTS FOR (α,n) NEUTRONS. R. L. Becker and H. H. Barschall (Univ. of Wisconsin, Madison). Phys. Rev. 102, 1384-9(1956) June 1.

The usefulness of the $Be^9(\alpha,n)$ and the $C^{13}(\alpha,n)$ reactions as sources of monoenergetic neutrons of variable energy was investigated. Measurements of the yield of the $C^{13}(\alpha,n)$ reaction are presented. Total cross sections for elements of atomic number from 3 to 9 were measured for neutron energies between 4.4 and 5.6 Mev and between 7.6 and 8.6 Mev. The results give some information about energy levels in C^{13} and O^{17}. (auth)

9518
NEUTRON SPECTROMETRY BASED ON THE MEASUREMENT OF THE DECELERATING TIME OF NEUTRONS. L. E. Lazareva, E. L. Feinberg, and F. L. Shapiro (P. N. Lebedev Inst. of Phys.). Soviet Phys. JETP 2, 351-3(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 381-3 (1955) Sept. (In Russian)

The gradual monochromatization resulting from the deceleration of neutrons in a medium is developed as a method of neutron spectrometry. The theory of this method is discussed in some detail. (B.J.H.)

NUCLEAR PHYSICS

9519 UCRL-3374
California. Univ., Berkeley. Radiation Lab.
I. EXPERIMENTAL STUDY OF NUCLEAR ISOMERS IN THE MILLIMICROSECOND LIFETIME RANGE. II. APPLICATIONS OF NILSSON'S WAVE FUNCTIONS FOR DEFORMED NUCLEI (thesis). Donald Strominger. June 1956. 91p. Contract W-7405-eng-48. $0.50(OTS).

The method of delayed coincidences was used to search for metastable states with half lives in the millimicrosecond range. Metastable states were found in the following daughter nuclei: Pa^{231} $t_{½} = 4.1 \pm 0.4 \times 10^{-8}$ sec, Pb^{209}, $t_{½} = 3.1 \pm 1.0 \times 10^{-9}$ sec, and W^{184}, $t_{½} = 9 \pm 3 \times 10^{-10}$ sec.

In addition, the existence of short-lived metastable states in the daughter nuclides Pa^{231} and Pu^{239} was confirmed. Upper limits for the half-lives of other gamma transitions were set. A decay scheme for the Re^{184} is proposed. Several critical tests of Nilsson's wave functions were made for strongly deformed nuclei. The wave functions were used to calculate decoupling parameters, magnetic moments, and E1 transition probabilities. These calculated nuclear properties are compared with experimental data in the heavy element region. The calculated values are found to be generally in qualitative agreement with the experimental data. Nilsson's orbits are correlated with nuclear ground-state spins in the actinide region. New selection rules for E1 transitions are discussed. (auth)

9520

ON THE COULOMB EFFECT FOR THE INTERNAL BREMSSTRAHLUNG ACCOMPANYING BETA DECAY. S. Bertil Nilsson. Arkiv Fysik 10, No. 5, 467-77(1956).

Reference is made to the elementary picture of the radiative beta decay due to Knipp and Uhlenbeck, and to the modifications of the Born-approximation formula suggested by this picture to include the Coulomb effect. The main part of the paper is devoted to a more consistent theoretical treatment of allowed transitions, in which the Coulomb field is taken into consideration from the outset and not only in the end result. The calculation reported here is still approximate in considering only that contribution to the Coulomb effect which comes from the proper beta transition. A numerical integration in the case of S^{35} shows a not inconsiderable increase over the photon yield predicted by the elementary picture in the corresponding approximation (which is commonly employed to compare with experiment). However, in this approximation at least, the increase is not large enough to account for the very high yield observed in some recent experimental work. (auth)

9521

ON A STAR PRODUCED BY AN ANTIPROTON OBSERVED IN NUCLEAR EMULSIONS. O. Chamberlain, W. W. Ghupp, G. Goldhaber, E. Segre, and C. Wiegand (Univ. of California, Berkeley) and E. Amaldi, G. Baroni, C. Castagnoli, C. Franzinetti, and A. Manfredini (Univ. of Rome). Atti accad. nazl. Lincei, Rend., Classe sci., fis., mat. e nat. 19, 381-6(1955) Dec. (In Italian)

9522

EXPERIMENTAL STUDY OF THE INSTANTANEOUS α SUB-STRUCTURES IN C^{12}. Adham Samman. Compt. rend. 242, 2232-4(1956) Apr. 30. (In French)

Among 27 disintegrations of the type $p(\sim 340\ Mev) + C^{12} \rightarrow p' + 3\alpha$, an analysis is given of 8 of them for which the reaction process would be $p + C^{12} \rightarrow p' + \alpha + (Be^{8*} \rightarrow 2\alpha)$. For a certain initial α_1 energy, it is shown that p' and α_1 would come from a direct, single $p\text{-}\alpha_1$ collision, which would confirm the P. Cuer hypothesis of the phenomenological existence of instantaneous substructures. (tr-auth)

9523

ON THE RESONANCE ABSORPTION OF PHOTONS IN CARBON. Christophe Tzara. Compt. rend. 242, 2340-3 (1956) May 7. (In French)

A resonance in the absorption of photons by C^{12} should exist at 22.8 Mev; at this energy, the slope of the activation curve for the (γ,n) reaction shows a discontinuity attributed to a level of width $\Gamma < 40$ kev. The upper limit found for the effective absorption cross section indicates a width $\Gamma_n > 580$ kev for this level, in contradiction with the conclusions reached by the interpretation of activation curves. (tr-auth)

9524

GRAPHICAL METHOD OF DETERMINING PHASE CHANGE. Wladimir Paskievici and Philippe Pluvinage. Compt. rend. 242, 2550-2(1956) May 23. (In French)

9525

ROTATIONAL PERTURBATIONS IN NUCLEI—APPLICATION TO WOLFRAM 183. A. K. Kerman. Kgl. Danske Videnskab. Selskab. Mat.-fys. Medd. 30, No. 15, 1956. 25p.

A general discussion is given of the theory of rotational perturbations in nuclei. Applications to the determination of energy levels in W^{183} are also discussed. It is concluded that "rotation-particle coupling" is quite important in an odd nucleus such as W^{183}. (B.J.H.)

9526

MEASUREMENTS OF CONVERSION ELECTRONS FROM COULOMB EXCITATION OF THE ELEMENTS IN THE RARE EARTH REGION. Torben Huus, Jørgen H. Bjerregaard, and Bent Elbek. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 30, No. 17, 1956. 72p.

The experimental problems connected with measurements of the conversion electrons produced by Coulomb excitation of the heavier elements are discussed. The results of a series of measurements on elements with the atomic numbers 25, 26, 27, 60, 62 to 75, and 77 to 79 are given. Reduced transition probabilities are computed from the data and are compared with the results derived from lifetime measurements. By means of the unified model, nuclear moments are calculated from the measured excitation energies and transition probabilities. The values obtained are compared with the theory as well as with other experimental evidence, and in general the agreement is found to be satisfactory. (auth)

9527

ON THE UNIVERSAL INTERACTIONS. S. Oneda (Univ. of Manchester, England) and A. Wakasa (Kanazawa Univ.). Nuclear Phys. 1, 445-76(1956) May.

The possibility of explaining the complicated interactions between elementary particles in terms of universal interactions is discussed. Four types of interactions which seem to have a certain universal character are mentioned: electromagnetic interaction (e-int.), strong baryon-meson interaction (G-int.), weak Fermi interaction (f-int.), and weak boson-fermion interaction (g-int.). The possibility of having the unique coupling constant g for the last case is investigated by the analysis of decays of hyperons and K_μ mesons allowing their spin values to be up to 3/2 spin and 1 respectively. The best fit is found in the derivative couplings between spin 1/2 fermions and spin 0 bosons, but the possibility of including higher spin values is not completely ruled out. From a speculative multiple particle theory of g-int., the space inversion parity of elementary particles is determined from their decay modes. With the object of decreasing the number of universal interactions, the elimination of g-int. through the other three possible universal ones is discussed. It is shown, however, that this cannot be possible without adding a more complicated structure to f-int. Thus, merely by considering the ratio of $\pi \rightarrow \mu + \nu$ and $\pi \rightarrow e + \nu$ decay, it is concluded that (i) the coupling types of f-int. are process dependent, as long as the same value of the coupling constant is desired for f-int. The possible coupling types and their experimental tests are investigated. Moreover, it is shown that, in order to explain hyperon decays (ii) f-int. must be extended to four baryon (not neutrino) processes. Under the conditions (i) and (ii) there seems to remain, at present, the possibility that g-reactions such as hyperon decays and $K_\mu \rightarrow \mu + \nu$ etc. can be explained by such an intermediation, if (iii) the correct $\pi \rightarrow \mu + \nu$ decay life-time is given by the same mechanism. If any of the conditions (i), (ii) and (iii) does not hold, the coexistence of the elementary g-int. is the simplest and the most natural assumption. It is also shown that by the intermediary of these universal interactions, the interesting K-meson-decay modes $K_{2\pi} \rightarrow \pi + \pi^0$ and $K_3 \rightarrow \mu$ (or e) $+ \nu + \pi^0$, can be the alternative decay

modes of the same K-meson. In these discussions the perturbation treatments with regard to G-int. are avoided as much as possible. The elementarity of these interactions is briefly summarized and the existence of other sorts of interactions is referred to in connection with the existence of the χ-meson. The formulae of the decay probabilities due to g-int. are collected, including those of spin 3/2 particles. (auth)

9528

SURFACE OSCILLATIONS IN EVEN-EVEN NUCLEI. Lawrence Wilets (Institute for Theoretical Physics, Copenhagen, Denmark and Los Alamos Scientific Lab., N. Mex.) and Maurice Jean (Institut du Radium, Paris). Phys. Rev. 102, 788-96(1956) May 1.

Surface oscillations in nuclei with deformation potentials independent of the shape parameter γ are discussed, and are found to describe qualitatively the regularities in even-even nuclei of the type discussed by Scharff-Goldhaber and Weneser. (auth)

9529

PHOTOEJECTION OF HIGH-ENERGY NUCLEONS FROM NUCLEI AND THE QUASI-DEUTERON MODEL. I. CROSS SECTIONS AND ANGULAR DISTRIBUTIONS. A. C. Odian, P. C. Stein, A. Wattenbert, and B. T. Feld (Massachusetts Inst. of Tech., Cambridge) and R. Weinstein (Brandeis Univ., Waltham, Mass.). Phys. Rev. 102, 837-43(1956) May 1.

Experiments are described on the photoproduction of high energy neutron-proton pairs from complex nuclei. The results provide further confirmation and some clarification of the quasi-deuteron model of Levinger. In these experiments, targets of D, Li, and O are bombarded by a 340-Mev bremsstrahlung beam. In one set of measurements, intended to check the kinematical features of the model, we have observed the angular spread of the n−p coincidences which arises from the momentum distribution of nucleons in the complex nuclei. These observations were preliminary to the main group of measurements, which consisted in a direct comparison of the cross sections and angular distributions of quasi-deuteron disintegrations for Li and O to those from D for 260-Mev photons. (A more limited group of measurements is reported for 200-Mev photons.) The results of these observations indicate that the quasi-deuteron photodisintegration proceeds through the same mechanisms as are responsible for the photodisintegrations of free deuterons at the energies investigated. However, a quantitative understanding of the data, especially for the cross-section ratios, required an analysis of the effects of scattering of the emerging nucleons in the target nuclei. Qualitative arguments concerning these effects are given herein; the more quantitative discussion is postponed to a future communication. (auth)

9530

MULTIPLE THERMAL RELAXATION TIMES AND NUCLEAR SPIN ENERGY TRANSFER IN LIQUIDS. John E. Wertz, P. L. Jain, and R. L. Batdorf (Univ. of Minnesota, Minneapolis). Phys. Rev. 102, 920-1(1956) May 1.

It is suggested that distinguishable protons in a molecule have their own characteristic time for return to the ground state from an excited spin state. This would lead to different optimum values of the rf field H_1. Such differences were observed for protons in groups such as CH_3, CH_2, CH, OH, and others. (B.J.H.)

9531

EXAMPLE OF AN ANTIPROTON-NUCLEON ANNIHILATION. O. Chamberlain, W. W. Chupp, A. G. Ekspong, G. Goldhaber, S. Goldhaber, E. J. Lofgren, E. Segre, and C. Wiegand (Univ. of California, Berkeley) and E. Amaldi, G. Baroni, C. Castagnoli, C. Franzinetti, and A. Manfredini (Univ. of Rome, Italy). Phys. Rev. 102, 921-3(1956) May 1.

A stack of nuclear emulsions was exposed to the Berkeley bevatron beam which was adjusted for a momentum of 700 Mev/c. Complete descriptions of the experimental arrangement are included. An event was observed which is interpreted as an antiproton-nucleon annihilation. Measurements and data on the 8 prongs observed in the p^- star are tabulated. (B.J.H.)

9532

POLARIZATION OF BREMSSTRAHLEN. John M. Dudley, Fred W. Inman, and Robert W. Kenney (Univ. of California, Berkeley). Phys. Rev. 102, 925-6(1956) May 1.

The polarization of bremsstrahlung radiation was studied using the well collimated incident electron beam from the 35-Mev Stanford linear accelerator. In order to restrict multiple scattering in the target, a very thin radiator of low A was used. Nuclear emulsions were used as detectors. (B.J.H.)

9533

FURTHER ANALYSIS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY ANTIPROTON EVENT. H. S. Bridge, D. O. Caldwell, Y. Pal, and B. Rossi (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 102, 930-1(1956) May 1.

Photometric techniques were used to study the antiproton event. These measurements strengthen the hypothesis that the event was the annihilation of an antiproton, or less probably an antihyperon with an ordinary nucleon. (B.J.H.)

9534

EXPERIMENTAL CROSS SECTIONS FOR CHARGE-CHANGING COLLISIONS OF He^+ AND He^{++} IONS TRAVERSING GASES. S. K. Allison, J. Cuevas, and P. G. Murphy (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 102, 1041-8(1956) May 15.

Ion beams of He^+ and He^{++}, in the kinetic energy range 100 to 450 kev, are held in arcs of circular orbits in a magnetic field. When a few microns of gas are admitted the beam is attenuated by charge-changing collisions, since with change of charge the ion is lost from its orbit. Cross sections for such charge-changing collisions are designated by σ_{if}, where i is the initial positive ionic charge in electron units and f the charge after the collision. $(\sigma_{10} + \sigma_{12})$ has been directly measured for He^+ in hydrogen, helium, and air, and $(\sigma_{21} + \sigma_{20})$ for He^{++} in the same gases. Other observers have measured the equilibrium ratio He^+/He^{++} attained in a field-free beam after many collisions, and combining these data with our observations allows calculation of σ_{10} and σ_{12} separately if one assumes σ_{02} negligible compared to the other cross sections. The electron loss cross sections σ_{12} increase with energy for helium and air throughout the measured region and are of the order 10^{-17} cm^2; σ_{12} for hydrogen vs energy shows a broad maximum at about 370 kev and 0.98×10^{-17} cm^2 per hydrogen atom. The capture cross sections σ_{10} decrease rapidly in the measured energy range and in the region 200 to 450 kev those measured in helium agree, within the estimated experimental error, with theoretical calculations of H. Schiff. In attempting the resolution of the sums $(\sigma_{21} + \sigma_{20})$ into the separate cross sections it is found that the errors in the measurements accumulate to such an extent that the individual values become very unreliable. An auxiliary experiment designed to increase the accuracy of our knowledge of the separated capture cross sections σ_{20} and σ_{21} is in progress. (auth)

9535

NUCLEAR MATRIX ELEMENTS FOR ALLOWED β TRANSITIONS. W. C. Grayson, Jr. and L. W. Nordheim (Duke Univ., Durham, N. C.). Phys. Rev. 102, 1084-92(1956) May 15.

Nuclear matrix elements are evaluated for all allowed β transitions in the strict j-j coupling shell model, i.e., for

states of lowest seniority. The wave functions for the j^N configurations are obtained by algebraic means in the formalism of coefficients of fractional parentage. The matrix elements are given for the two assumptions, firstly that isotopic spin is a good quantum number, and secondly that the neutrons and protons are coupled separately to their lowest seniority states. The latter includes the case where the protons end in a $j = l + \frac{1}{2}$ shell, while the neutrons end in the $j = l - \frac{1}{2}$ shell. A similar explicit form is given for the magnetic moments of the states of the j^N configuration with seniority one. (auth)

9536

UNFAVORED FACTORS FOR ALLOWED β TRANSITIONS. W. C. Grayson, Jr. and L. W. Nordheim (Duke Univ., Durham, N. C.). Phys. Rev. 102, 1093-7(1956) May 15.

Unfavored factors U, that is, ratios of computed-to-observed transition probabilities, are tabulated in a systematic manner for allowed β transitions in the strict j-j coupling scheme. The introduction of many-particle wave functions lowers the gap between favored and unfavored transitions, but does not eliminate it. The systematics brings out clearly the role of configuration interaction through a strong correlation between the U factors and the expected purity of the shell-model wave functions. The matrix elements for even-A nuclei are on the average larger than those for odd-A nuclei and thus explain without any new hypothesis the lower average ft values for the even-A group. (auth)

9537

OPTICAL-MODEL POTENTIAL FOR NUCLEONS SCATTERED BY NUCLEI. W. B. Riesenfeld and K. M. Watson (Univ. of Wisconsin, Madison). Phys. Rev. 102, 1157-63(1956) May 15.

The Serber model of high-energy nuclear interactions permits one to express the "optical-model" potential for nucleons in terms of nucleon-nucleon scattering amplitudes. The potential is written in terms of four well-depth parameters in the form $V_C = -[V_{CR} + iV_{CI}]\rho(r) + [V_{SR} + iV_{SI}](\hbar/\mu c)^2(1/r)(d\rho/dr)\sigma\cdot l$, and experiments necessary to determine the four parameters V_{CR}, V_{CI}, V_{SR}, and V_{SI} are discussed. The explicit relations between the parameters and nucleon-nucleon scattering amplitudes are given and existing experimental data are reviewed. The phase shifts of Feshbach and Lomon have been used to calculate V_{CR}, V_{SR}, and V_{SI}. These values seem to reproduce the qualitative features of the "measured" values of these quantities. (A quantitative comparison is not possible, since analyses of the experimental data are not sufficiently complete.) (auth)

9538

UNRESTRICTED HARTREE-FOCK METHOD. George W. Pratt, Jr. (Massachusetts Inst. of Tech., Lexington, Mass.). Phys. Rev. 102, 1303-7(1956) June 1.

The unrestricted Hartree-Fock method is based upon the use of a single-determinant total wave function in which orbitals of the same n, l, and m_l values but different m_s values are regarded as being independent. The differences which arise between such orbitals are discussed. It is shown, using the Li atom as an example, that these differences are not merely a result of using a single determinant which has improper symmetry, but arise when the full spin-degeneracy problem is carried through. Conclusions for Li are generalized to more complicated systems. The influence of the unrestricted Hartree-Fock method on the calculation of magnetic form factors, its influence on hyperfine interactions, and its bearing on antiferromagnetism is pointed out. (auth)

9539

COHERENT NEUTRON SCATTERING AMPLITUDES OF KRYPTON AND XENON, AND THE ELECTRON-NEUTRON INTERACTION. M. F. Crouch, V. E. Krohn, and G. R. Ringo (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 1321-4(1956) June 1.

The coherent scattering amplitudes of krypton and xenon for thermal neutrons have been measured by a comparison method involving reflection of a neutron beam from liquid mirrors. The results were $(7.68 \pm 0.19) \times 10^{-13}$ cm for krypton and $(5.10 \pm 0.17) \times 10^{-13}$ cm for xenon. When these results are used with the scattering measurements of Hamermesh, Ringo, and Wattenberg, one obtains (3900 ± 800) ev for the electron-neutron interaction. (auth)

9540

REALISTIC INDEPENDENT-PARTICLE MODEL OF THE NUCLEUS. Alex E. S. Green (Florida State Univ., Tallahassee). Phys. Rev. 102, 1325-34(1956) June 1.

A phenomenological central potential is explored which is characterized by a universal depth (V_0), a universal surface extension (d), and an inner radius function $\alpha = \alpha_1 A^{1/3} + \alpha_0$. The four parameters are adjusted to be in accord with experimental information obtained from low-energy neutron scattering and from neutron separation energies. The results $V_0 = 40$ Mev, $d = 1$, $\alpha_1 = 1.32$, and $\alpha_0 = -0.8$ (all in units of 10^{-13} cm), are in reasonable accord with what might be expected from other experimental and theoretical considerations. Since the experimental data used in the adjustment process bound the energy region in which the discreteness of nuclear energies is most evident, one might expect that the eigenvalues and eigenfunctions based upon this phenomenological model would furnish a highly realistic set for the theoretical study of low-energy nuclear transitions within the framework of the independent-particle model of the nucleus. The energy eigenvalues and the important parameters for the energy eigenfunctions are calculated by a procedure suitable for the restricted type of potential under consideration. A simple method is presented for handling small perturbations, particularly the Coulomb perturbation. In the latter case, it is shown that the derived proton eigenvalues agree with experimental proton separation energies, provided one introduces an anomalous attractive potential which cancels approximately one-half of the classical Coulomb potential acting upon an individual proton. The implications of these results are discussed. (auth)

9541

THE SCALAR FIELD OF A STATIONARY NUCLEON IN A NON-LINEAR THEORY. N. V. Mitskevich (Moscow State Univ.). Soviet Phys. JETP 2, 197-202(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 354-61(1955) Sept. (In Russian)

The properties of a spherically symmetrical non-linear scalar potential are investigated in detail, using the method of Chaplygin. An approximate numerical solution is derived, and the relation between self-energy and charge of a nucleon is obtained. (auth)

9542

THE THEORY OF THE ACCELERATION OF CHARGED PARTICLES BY ISOTROPIC GAS MAGNETIC TUBULENT FIELDS. S. A. Kaplan (L'vov Univ.). Soviet Phys. JETP 2, 203-10(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 406-16(1955) Oct. (In Russian)

A theory of the acceleration of charged particles by magnetic turbulence is developed. A kinetic equation is derived to determine the spectrum of rapid particles, and a method is given for solving this equation for various cases (stationary and non-stationary spectrum, account of magnetic-braking losses, etc.). The investigation makes a wide use of the method of the theory of shower processes in cosmic rays. (auth)

NUCLEAR PROPERTIES

9543 ORNL-2142
Oak Ridge National Lab., Tenn.
SUMMARY OF SOME NEW NUCLEAR DATA. P. R. Kasten. Aug. 21, 1956. 13p. Contract W-7405-eng-26. $0.20(OTS).

Results obtained by different investigators of nuclear constants of U^{233}, Pu^{239}, Pu^{241}, U^{235}, Pu^{240}, Pu^{238}, Pu^{242}, and Am^{243}, are summarized. (B.J.H.)

9544 OSR-TN-56-152
Stanford Univ., Calif.
THE ZERO-ZERO TRANSITION IN CARBON 12. Technical Report No. 15. B. F. Sherman and D. G. Ravenhall. Mar. 1956. 19p. Project No. R-357-40-3. Contract AF18(600)-545.

The electric monopole transition density between the ground state and the 7.68-Mev level of C^{12} is examined on the basis of the nuclear shell model. It is found to vanish for all stages of intermediate coupling if only the $(1p)^6$ configuration is involved. A nonzero value is obtained by including states of the $(1p)^7(2p)$ configuration, brought in by a residual central internucleon interaction. For computational simplicity, both this and the spin-orbit interaction are first treated as perturbations about the L-S limit. Since the results show that the residual interaction is probably too large for this to be reliable, an attempt is made to diagonalize the Hamiltonian exactly, but the severe restriction on the number of states considered makes the result rather unsatisfactory. It is concluded that if all of the possible states of the low-lying configurations were to be included in the diagonalization, agreement with experiment might result, but that in this case some semi-collective model might better be applied to the problem. (auth)

9545
STUDIES ON THE NUCLEAR PHOTOEFFECT. M. D. de Souza Santos, J. Goldemberg, R. R. Pieroni, E. Silva, Ottavia A. Borello, and Suzanna S. Villaca (Universidade de Sao Paulo, Brazil) and J. Leite Lopes (Universidade do Brazil and Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Anais acad. brasil. cinc. 27, No. 4, 437-70(1955). (In English)

Photonuclear reactions induced in several elements by the x-ray beam of the University of São Paulo 24-Mev betatron were accurately measured by means of the residual activity technique. Thresholds and cross-sections for different photonuclear processes were measured with a fairly high accuracy and are discussed in this paper. Some influence of shell structure on the photoprocesses is presented. (auth)

9546
SPECIAL STUDY OF THE 7.6 LEVEL IN C^{12}. J. Catalá, E. Villar, and A. Bonet. Anales real soc. espãn. fís. y quim. (Madrid), Ser. A 52, 93-100(1956) Mar.-Apr. (In Spanish)

When C^{12} is bombarded with deuterons, some of them will be inelastically scattered, leaving the C^{12} in an excited level. The possibility of finding an excited level at 7.6 Mev for the C^{12} nucleus, when acetylene gas is bombarded with 19-Mev deuterons has been studied by the photographic method. The angular distribution in center-of-mass system corresponding to that level is calculated and a very low mean value of the differential cross section was found. (auth)

9547
PROTON-γ ANGULAR CORRELATION IN THE $B^{10}(d,p)B^{11}$ REACTION. Serge Gorodetzky, Andre Gallmann, Michel Croissiaux, and Raymond Armbruster. Compt. rend. 242, 2545-6(1956) May 23. (In French)

A coincidence spectrometer was used to measure the p-γ angular correlation for the 2.14-Mev level of B^{11}. The angular correlation was found to be isotropic within the statistical limits of error. (B.J.H.)

9548
DETERMINATION OF RATIOS OF INTERNAL CONVERSION COEFFICIENTS FOR In^{114} ISOMERIC TRANSITION. V. M. Kel'man, R. Ya. Metskhvarishvili, V. A. Romanov, L. I. Rusinov, and K. A. Konoplev. (Leningrad Physico-Technical Inst.). Doklady Akad. Nauk S.S.S.R. 107, 394-7(1956) Mar. 21. (In Russian)

Conversion of electron spectra following the isomeric transition of In^{114} (energy of transition 192 kev) was investigated on a prismatic β spectrometer and the ratios of internal conversion coefficients were found. The measurements were made on the instrument with half width lines of 0.04%, and spectrometer resolving power of 0.02% from 2π. The resolving power of the instrument permitted electrons with L-subshells and M- and N-subshells of In^{114} to be divided, and the ratios of corresponding coefficients to be found. (R.V.J.)

9549
ON THE ANOMALOUS MAGNETIC MOMENTS OF THE NUCLEONS. S. P. Misra and B. B. Deo (Ravenshaw Coll., Cuttack, India). Indian J. Phys. 30, 16-28(1956) Jan.

The anomalous magnetic moments of nucleons were calculated using a fourth order meson equation given by Bhabha and Thirring. The electromagnetic current density of this meson field has been evaluated for this purpose. The results are in much better agreement with the experiments than those obtained in conventional meson theories. (auth)

9550
CONTRIBUTION TO THE STUDY OF SHELL ELECTRON CAPTURE BY THE NUCLEI OF ATOMS: EFFECT OF THE CORRELATIONS EXISTING BETWEEN THE ELECTRON POSITIONS ON THE RATIO ρ OF THE PROBABILITY OF L CAPTURE TO THAT OF K CAPTURE. Simone Odiot and Raymond Daudel. J. phys. radium 17, 60-2(1956) Jan. (In French)

It is shown that this usually neglected effect is very important for light atoms since, in the case of the first triplet state of He, it leads to a value of the capture ratio of about 10 times greater than that which results from Marshak's theory. In the case of heavier atoms, it was not possible to introduce all the correlations. It is probable that its role is rapidly lessened when the atomic number increases. In the case of A, the effect of the Pauli correlations is no larger than about 25%. It leads, in fact, to a value of 0.10 for the ratio ρ, while the simplified theory gives 0.08. (tr-auth)

9551
NUCLEAR QUADRUPOLE RESONANCE. H. Kopfermann. J. phys. radium 17, 366-71(1956) Apr. (In French)

The methods which provide information on the electric quadrupole moments of nuclei are surveyed. The method of pure nuclear quadrupole resonance discovered in 1949 by Dehmelt and Kruger is reviewed. The discussion of the principle of the method and of the experimental techniques is followed by a review of the results obtained using this method. (tr-auth)

9552
THE INTERACTION OF NEUTRON AND ALPHA-PARTICLE. E. Van Der Spuy (Univ. of Manchester, England). Nuclear Phys. 1, 381-414(1956) May.

The phenomenological neutron-alpha interaction is determined from the phase shifts in the scattering of neutrons on alpha particles, over the neutron energy range 0 to 10 Mev. From the notion of the alpha particle, acting as a single unpolarised unit in the scattering, comes the assumption that the interaction is mainly of the ordinary velocity-independent type, which may be easily subjected to phenomenological analysis. A new general analysis relates useful phase

parameters to parameters defining interaction potential. For a consistent solution, on the basis of an ordinary potential with spin orbit coupling, which would give the main phase data, for the S, P and D waves, one requires the interpretation of the S phases in terms of an attractive potential which has one bound state, rather than by a predominantly repulsive interaction. In this interpretation the 'bound state' is not observed because the wave function for the corresponding $(ls)^5$ state will vanish identically by the exclusion principle. Using the group resonance formalism the ordinary potential so obtained can be related to fundamental force parameters in a consistent way, because the neutron-alpha interaction is indeed seen to have only a secondary velocity-dependence for these force parameters. The fundamental force parameters are close to those required by low energy nucleon-nucleon data; they give the correct alpha binding energy, and have an exchange character which is non-saturating without a repulsive core. (auth)

9553

THE TWO-BODY SPIN-ORBIT FORCE. G. Abraham (Atomic Energy Establishment, Bombay). Nuclear Phys. 1, 415-19(1956) May.

A first order estimate is made of the two-body spin-orbit force from the ^2P splitting of Li^7. Considered together with recent work on He^5, the estimated spin-orbit force makes a large change in the calculation of the binding energy of the deuteron. (auth)

9554

ON THE RATIO BETWEEN THE ACTIVATION CROSS SECTIONS OF ^{84}Sr AND ^{88}Sr FOR SLOW NEUTRONS. M. Asdente, A. Bisi, E. Germagnoli, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuclear Phys. 1, 420-4(1956) May.

Samples of $SrCO_3$, irradiated in a nuclear reactor, have been used to determine the ratio between the activation cross sections of the two processes $Sr^{84}(n, \gamma)\ Sr^{85}$(65 d) and $Sr^{88}(n, \gamma)\ Sr^{89}$. Methods of absolute β and γ counting have been used for this purpose. The ratio between the two isotopic cross sections is found to be 318 ± 21, from which an activation cross section of 1.59 ± 0.11 barns can be calculated for the reaction $Sr^{84}(n, \gamma)\ Sr^{85}$(65 d), if the value 5×10^{-3} barns is assumed for the cross section of the process $Sr^{88}(n, \gamma)\ Sr^{89}$. (auth)

9555

BETA DECAY OF ^{161}Tb AND LOW-LYING LEVELS IN ^{161}Dy. A. Bisi, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan). Nuclear Phys. 1, 425-32(1956) May.

The β^- and γ radiation from Tb^{161} were analyzed by means of a scintillation spectrometer, a proportional counter, a β-ray spectrometer and $\gamma-\gamma$ and $\beta-\gamma$ coincidence techniques. Gamma rays were observed at energies 25.9 ± 0.2, 49 ± 2, 77 ± 2 kev. The end-point of the β^- spectrum occurs at 500 ± 3 kev. The half life was found to be $T_{1/2} = 6.9 \pm 0.1$ d. A decay scheme is proposed. (auth)

9556

POLARISATION OF HIGH ENERGY NUCLEONS SCATTERED BY NUCLEI. H. S. Köhler (Univ. of Uppsala, Sweden). Nuclear Phys. 1, 433-44(1956) May.

Calculations have been made of the polarization of protons scattered by nuclei at 135 and around 300 Mev. With a spin-orbit coupling similar to that used by E. Fermi, good agreement with experiments made at Harwell and Berkeley is obtained for medium and heavy elements but not for the lightest. An explicit formula for the polarization of neutrons is derived by certain approximations and discussed. (auth)

9557

SOME MEASUREMENTS ON THE SPECTRAL LINE SHAPE AND WIDTH OF A PARAMAGNETIC RESONANCE ABSORPTION LINE. F. Bruin and M. Bruin. Physica 22, 129-40 (1956) Feb.

Paramagnetic resonance of the free radical DPPH is measured at a frequency of 20 Mc s^{-1} by means of a simple autodyne detector. The results of the experiments are compared with the Anderson-Weiss model of exchange narrowing. In agreement with this theory a Lorentz line shape is found. The half-value width decreases with increasing temperature and is larger than the value at microwave frequencies. The width as a function of concentration shows a sharp increase going from the crystalline state to the solution in a liquid. The imaginary peak susceptibility χ'' is measured and found to be in agreement with the theoretical value. (auth)

9558

NUCLEAR QUADRUPOLE COUPLING IN POLAR MOLECULES. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.) and H. M. Foley (Columbia Univ., New York). Phys. Rev. 102, 731-2(1956) May 1.

The quadrupole moment induced in various ions by the nuclear electric quadrupole moment Q has been recalculated to higher accuracy than in a previous paper. Values are presented for the ratio γ_∞ of the induced moment to Q for the Na^+, Cl^-, Cu^+, Rb^+, and Cs^+ ions. These values of γ_∞ enter into the quadrupole coupling of polar molecules, which is given by $q \cong 2e(1 + |\gamma_\infty|)/R^3$ (R = internuclear distance) provided that the exchange repulsion of the ions can be neglected. The calculated values of γ_∞ are of order 10 to 100, in agreement with experimental evidence from the measured values of q for several polar molecules. (auth)

9559

VARIATIONAL APPROACH TO THE QUADRUPOLE POLARIZABILITY OF IONS. T. P. Das and R. Bersohn (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 102, 733-8(1956) May 1.

A variation method has been developed for treating the problem of polarization of electron shells of ions by external charges. The induced quadrupole moment has been calculated for a number of He-like ions and the two Ne-like ions Al^{+++} and Na^+. For the former a shielding effect occurs, while for the latter a net antishielding effect is obtained in agreement with Sternheimer's conclusions. It is possible to compare the results of Sternheimer's numerical solution of the first-order Schrödinger equation with the variation method used here in the case of Na^+. Agreement is reasonably good. (auth)

9560

PARAMAGNETIC RESONANCE HYPERFINE STRUCTURE OF Co^{56}. R. V. Jones, W. Dobrowolski, and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 102, 738-9 (1956) May 1.

The microwave paramagnetic resonance hyperfine structure of 72-day Co^{56} has been observed in a magnetically dilute single crystal of cobalt potassium sulfate at 20°K. From the number of hfs components and their spacing relative to Co^{59}, the spin $I(Co^{56}) = 4$ and the magnetic moment $|\mu(Co^{56})| = 3.855 \pm 0.007$ nm are directly determined. These results are discussed in relation to those of nuclear alignment experiments and the nuclear shell model. (auth)

9561

ENERGY LEVELS OF Pu^{239} POPULATED BY THE BETA DECAY OF Np^{239}. J. M. Hollander, W. G. Smith, and J. W. Mihelich (Univ. of California, Berkeley). Phys. Rev. 102, 740-6(1956) May 1.

The conversion electron spectrum arising from the beta decay of 2.3-day Np^{239} has been studied with three 180° permanent magnet photographic spectrographs. The following transitions, with multipolarities where known, were observed (energy in kev): 44.64 (M1 + E2), 49.40

(M1 + E2), 57.25 (E2), 61.4 (E1), 67.82 (E2), 106.1 (E1) 106.4, 181.8, 209.9 (M1), 226.4, 228.4 (M1), 254.6, 273.1, 277.7 (M1), 285.6, 316.1, and 334.5. Gamma-gamma coincidence experiments have also been performed. It is necessary in order to account for the present data to modify the previously accepted level scheme for Pu^{239}; a revised scheme is presented, with spin and relative parity assignments. The energy and intensity data are discussed in terms of the Bohr-Mottelson unified nuclear model. A rough measurement of the Auger coefficient in Z = 94 is reported, and also an experimental value for the K-electron binding energy in plutonium is given. (auth)

9562

MASS ASSIGNMENT OF THE 44-MINUTE CALIFORNIUM-245 AND THE NEW ISOTOPE CALIFORNIUM-244. Alfred Chetham-Strode, Jr., Gregory R. Choppin, and Bernard G. Harvey (Univ. of California, Berkeley). Phys. Rev. 102, 747-8(1956) May 1.

The 44-minute californium alpha emitter previously thought to be Cf^{244} has been reassigned to mass number 245 on the basis of milking experiments, excitation functions, cross bombardments, and decay-scheme studies. Californium-245 decays by the emission of (7.11 ± 0.02)-Mev alpha particles (~30%) and by orbital electron capture (~70%). The new isotope Cf^{244} was also identified and found to decay by the emission of (7.17 ± 0.02)-Mev alpha particles with a half-life of 25 ± 3 minutes. The mass assignment of this isotope was established by its genetic relationship to Cm^{240} and by the excitation function for its formation by the (α,4n) reaction on Cm^{244}. (auth)

9563

ANGULAR MOMENTA AND PARITIES OF THE EXCITED STATES OF Cd^{114}. J. N. Brazos and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys. Rev. 102, 753-61(1956) May 1.

Angular correlation experiments have been performed on the 0.722—0.556-Mev gamma-gamma cascade of Cd^{114} in order to determine the angular momenta and the parities of the nuclear states involved. The directional correlation of the two gamma rays is indicative of a pure quadrupole–pure quadrupole cascade between states of angular momentum quantum number 4, 2 and 0. The polarization-directional correlation experiments show that all three states involved have the same parity, and furthermore, give strong support to the angular momentum assignment mentioned above. Hence, the K-capture decay in In^{114} which precedes this gamma-gamma cascade must originate in the 50-day isomeric state of In^{114} with I = 5 and not in the 72-sec ground state with I = 1. Observations of the gamma radiation directly following the 72-sec decay confirmed this result. Directional correlation measurements on ten In^{114} sources of very different chemical and physical structure did not reveal any evidence of extranuclear perturbation effects on the Cd^{114} gamma-gamma correlation. (auth)

9564

GAMMA RAYS FROM NEUTRON INELASTIC SCATTERING. Robert B. Day (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 767-87(1956) May 1.

A NaI scintillation counter has been used to observe gamma rays from neutron inelastic scattering in B^{10}, C, N, O, F, Mg, Al, S, Ca, Fe, Ni, Cu, Ta, Pb, and Bi. In most cases these gamma rays can be fitted into known level schemes of the target nuclides; however, a few gamma rays require the existence of previously undetected levels. In addition, several gamma rays have been observed from (n,p'γ) and (n,α'γ) reactions. The problems involved in measuring absolute cross sections for the production of gamma rays are considered in detail. The usefulness of neutron inelastic scattering in nuclear spectroscopy is illustrated in several cases. (auth)

9565

NEUTRON ABSORPTION CROSS SECTIONS OF U^{235} AND Pu^{239} IN THE 5- TO 50-KEV ENERGY RANGE. R. L. Macklin, H. W. Schmitt, and J. H. Gibbons (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 797-9(1956) May 1.

The absorption cross sections of U^{235} and Pu^{239} have been measured at six energies in the 5- to 50-kev energy range. Neutrons from the reaction V^{51}(p,n)Cr^{51} were used in spherical-shell transmission measurements. The results show, in general, a decrease in absorption cross section with increasing energy up to about 30 kev and then a nearly constant value (up to 50 kev) of about 2.6 barns for U^{235} and 2.2 barns for Pu^{239}. (auth)

9566

RADIATION FROM EXCITED STATES OF CARBON-13. R. J. Mackin, Jr., W. R. Mills, Jr., and J. Thirion (California Inst. of Tech., Pasadena). Phys. Rev. 102, 802-5(1956) May 1.

A scintillation spectrometer and a magnetic lens spectrometer have been used to study gamma rays from excited states of C^{13} at 3.84 and 3.68 Mev, produced in the reactions C^{12}(d,p)C^{13*} and B^{10}(α,p)C^{13*}. Lines have been measured at 169.5 ± 0.4 kev, 3.844 ± 0.015 Mev, and 3.69 ± 0.02 Mev. The last one was shown to exhibit a Doppler shift, suggesting a lifetime less than 3×10^{-13} second. The 170-kev line was shown to result from a transition between the 3.84- and 3.68-Mev levels, indicating a level energy of 3.675 ± 0.015 Mev. Its internal conversion coefficient was found (assuming an isotropic distribution) to be $(1.4 \pm 0.3) \times 10^{-4}$, consistent with electric dipole radiation. Lack of knowledge of the angular distribution adds to the uncertainty and makes it impossible to rule out magnetic dipole radiation. Relative line intensities showed that the upper level decayed through the 3.68-Mev level with a probability 0.24 ± 0.05. Transitions to the 3.1-Mev level were not detected and were concluded to have intensities less than 3% of the ground-state transitions. (auth)

9567

DECAY OF As^{72}. E. Brun, J. J. Karushaar, and W. E. Meyerhof (Standard Univ., Calif.). Phys. Rev. 102, 808-13 (1956) May 1.

The γ rays following the decay of As^{72} have been studied with scintillation spectrometers both single and in coincidence. Sixteen γ rays have been resolved and have necessitated the addition of levels at 2.91 and 3.74 Mev to the levels of Ge^{72} known from previous studies of the radiations of Ga^{72}. From delayed coincidence measurements γ rays of 1.75, 2.24, and 3.0 Mev, in addition to annihilation radiation, have been observed to populate the isomeric (0^+) state in Ge^{72} at 0.69 Mev. (auth)

9568

GAMMA-GAMMA ANGULAR CORRELATION IN THE DECAY OF CHLORINE-34. Harry E. Handler and J. Reginald Richardson (Univ. of California, Los Angeles). Phys. Rev. 102, 833-6(1956) May 1.

The directional angular correlation between the 1.16- and 2.10-Mev γ which follow the decay of 32.4-minute Cl^{34} has been measured. Samples of Cl^{34} were produced in the UCLA cyclotron by the (p,pn) reaction and were produced in both solid and liquid form. Sodium iodide scintillation counters with subsequent pulse-height discrimination and standard coincidence techniques were used and the method was tested on the cascade of Ni^{60} giving satisfactory agreement with previous results. The results on S^{34}, although not unambiguous, are consistent with the assignment of spin 2 and even parity to both the first and second excited states of S^{34} with the 1.16-Mev gamma ray being 1.7% electric quadrupole and 98.3% magnetic dipole radiation. (auth)

9569

NARROW ELECTRON SPIN RESONANCE IN CHARRED DEXTROSE. Ricardo C. Pastor, John A. Weil, Thomas H. Brown, and John Turkevich (Princeton Univ., N. J.). Phys. Rev. 102, 918-19(1956) May 1.

A strong electron spin resonance, with full width at half-height of at most 1.1 gauss, was found in charred dextrose. The resonance was studied at 9400 Mc sec^{-1} using a standard microwave spectrometer with a 723A/B kylstron and a rectangular transmission cavity. The effect of various gases on the samples was studied. (B.J.H.)

9570

LOWEST STATES OF PARTICLE EXCITATION IN EVEN-EVEN NUCLEI. R. Thieberger and I. Talmi (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 102, 923-5 (1956) May 1.

Energies of the first excited states of various nuclei are calculated using harmonic oscillator wave functions and assuming pure jj coupling configurations. The calculated values are tabulated and compared to experimental values. (B.J.H.)

9571

LONG-LIVED LEAD-205. J. R. Huizenga and J. Wing (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 926-7(1956) May 1.

A further search was made for Pb^{205} by bombarding normal lead with 1500 μa hr of 21-Mev deuterons in the Argonne cyclotron. Resultant 11-kev γ activity is interpreted as Tl L x rays associated with the L electron capture of Pb^{205}. (B.J.H.)

9572

EXPERIMENTAL VERIFICATION OF THE OVERHAUSER NUCLEAR POLARIZATION EFFECT. Thomas R. Carver (Princeton Univ., N. J.) and Charles P. Slichter (Univ. of Illinois, Urbana). Phys. Rev. 102, 975-80(1956) May 15.

The experimental verification of Overhauser's proposal for polarizing nuclear spins is described. The effect on the nuclear magnetic resonance of saturating the electron spin resonance in several appropriate systems was observed at low fields and room temperatures. The systems investigated were: metallic Li, metallic Na, and Na dissolved in anhydrous liquid ammonia. The nuclear resonances of Li^7, Na^{23}, and H^1 (in the ammonia) were observed at 50 kc/sec in fields of 30.3 gauss, 44.2 gauss, and 11.7 gauss, respectively, and the electron spin resonances were saturated with the corresponding applied frequencies of 84, 124, and 33 Mc/sec. The detailed predictions of Overhauser were confirmed as far as nuclear polarization is concerned, although other relaxation processes in Li reduce the polarization, and the difficulty in completely saturating the metallic Na electron resonance leads to a partial effect. Only in fairly concentrated solutions of Na in ammonia was a substantially complete effect observed in which the proton nuclear polarization increased by the ratio of the electron gyromagnetic ratio to the nuclear gyromagnetic ratio. The proton line widths in the Na-ammonia solutions further verify the theory of Kaplan and Kittel. (auth)

9573

ELECTRON SCATTERING IN THE K-ELECTRON—GAMMA ANGULAR CORRELATION IN Sn^{117}. Robert K. Golden and Sherman Frankel (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 102, 1053-7(1956) May 15.

From directional correlation measurements using sources of various thicknesses, the angular correlation coefficient, b_2A_2, for the K-electron—gamma cascade in Sn^{117} is found to be -0.143 ± 0.011. This requires a mixture of $(0.15_{-0.10}{}^{+0.15})$ % E2 in the predominantly M1 $\frac{3}{2} \rightarrow \frac{1}{2}$ transition. The sign of the mixture ratio is positive. The theory describing the reduction of the angular correlation coefficient as the result of multiple elastic scattering in the source is shown to be valid for rather thick sources where even inelastic scattering is appreciable. (auth)

9574

ANGULAR CORRELATION OF GAMMA RAYS IN Pb^{204m}. J. R. Huizenga, V. E. Krohn, and S. Raboy (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 1063-5(1956) May 15.

The anisotropies of the three pairs of gamma rays in the triple cascade of 1.1-hour Pb^{204m} have been measured. The results were 0.163 ± 0.010 for the 374–899 kev (prompt) pair; 0.414 ± 0.015 for the 913–899 kev pair; and 0.398 ± 0.011 for the 913–374 kev pair. These results are consistent with the scheme, 9(E5)4(E2)2(E2)0. (auth)

9575

ATOMIC MASSES FROM C^{12} TO Ne^{22}. M. E. Kettner (Univ. of Minnesota, Minneapolis). Phys. Rev. 102, 1065-70(1956) May 15.

Doublets leading to mass values of the stable isotopes from C^{12} to Ne^{22} have been measured with a double-focusing mass spectrometer. In the determination of C^{12}, two new cycles have been used, $(\frac{1}{2}C_4H_4O-O^{18}O)-(H_3O-HO^{18})$ and $(\frac{1}{2}C_4H_2O-O^{17}O)-(H_3O-H_2O^{17})$, resulting in the value $C^{12} = 12.003814 \pm 6$ amu. An analysis of the available data pertinent to the investigated mass region is presented in an effort to uncover specific measurements most likely responsible for the discrepancies in mass values reported from the various sources of investigation. It is found that a generally improved agreement is obtained if adjustments are made in the following reactions: $O^{18}(p,\alpha)N^{15}$, $F^{19}(d,\alpha)O^{17}$, $Ne^{21}(d,\alpha)F^{19}$, and $Ne^{20}(d,\alpha)F^{18}$. (auth)

9576

ATOMIC MASSES OF H^1, D^2, C^{12}, AND S^{32}. K. S. Quisenberry, T. T. Scolman, and A. O. Nier (Univ. of Minnesota, Minneapolis). Phys. Rev. 102, 1071-5(1956) May 15.

The large double-focusing mass spectrometer recently developed has been used to measure a series of 25 mass doublets. This instrument features a new peak-matching method of measurement which involves the presentation of a portion of the mass spectrum upon an oscilloscope. A group of consistency tests has been performed to prove the correctness of the mass dispersion formula used in calculating mass differences. The measured doublets are sufficient to calculate the mass of C^{12} by five different cycles and also to calculate the masses of H^1, D^2, and S^{32}. The resulting mass values are $H^1 = 1.0081442 \pm 2$, $D^2 = 2.0147406 \pm 6$, $C^{12} = 12.0038167 \pm 8$, and $S^{32} = 31.9822401 \pm 9$ amu, where the errors shown include the statistical standard error and the resistance calibration uncertainty. A discrepancy exists between the mass values determined here and some of those derived from nuclear reaction energy data. (auth)

9577

ATOMIC MASSES OF THE STABLE ISOTOPES, $10 \leq A \leq 30$. T. T. Scolman, K. S. Quisenberry, and A. O. Nier (Univ. of Minnesota, Minneapolis). Phys. Rev. 102, 1076-83(1956) May 15.

The masses of all stable isotopes in the range $10 \leq A \leq 30$ have been measured using the large double-focusing mass spectrometer recently constructed. No serious discrepancies are found between the present results and other mass spectroscopic measurements except at Ne^{20}. The masses calculated from nuclear reaction energies are, with the exception of F^{19}, lower than the present results. The agreement between the Q-value masses and the present mass spectrometric results is not improved by changing the mass spectrometric secondary standard C^{12} to agree with the Q-value result or by making the same percentage change in all mass doublet values. Neither is the agreement improved by a change in either the calibration of the nuclear spectrom-

eters or the mass-energy conversion factor. Three Q-values which are inconsistent with other Q-values and also with the mass spectrometric results were eliminated from the nuclear reaction data and the Q-value masses recalculated. The new masses are in better agreement with the mass spectrometric results, but are still, with the exception of F^{19}, lower than the present mass spectrometric values. (auth)

9578

SCATTERING OF 40-MEV PROTONS FROM He^4. R. M. Eisberg (Univ. of Minnesota, Minneapolis). Phys. Rev. 102, 1104-8(1956) May 15.

The existence of an excited state in He^4 may be investigated by bombarding these nuclei with a monoenergetic beam of protons and looking for a group of inelastically scattered protons corresponding to excitation of the state. Using this technique at a bombarding energy of 32 Mev, Benveniste and Cork found no evidence of a state in He^4 of excitation energy less than 23 Mev. The 40-Mev beam of the Minnesota proton linear accelerator has been used to extend the search for a state in He^4 to higher excitation energies. A gas target was bombarded and particles emitted at forward angles were detected in a scintillation counter which measured their energy. By observing the energy loss in traversing thin foils, the masses of the emitted particles were determined. Elastically scattered protons and recoil He^4 were seen, as well as deuterons and recoil He^3 from the ground state (p,d) reaction. A continuum of protons from (p,2p) and (p,pn) reactions was observed. No evidence was found for a group of inelastically scattered protons corresponding to excitation of a state in He^4 of energy less than 28 Mev. (auth)

9579

NUCLEAR MOMENTS OF Am^{241} AND Am^{243}. Thurston E. Manning, Mark Fred, and Frank S. Tomkins (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 1108(1956) May 15.

The following values have been derived from measurements of hyperfine structure in the spectrum of americium: $\mu_{241} = +1.4$ nm, $Q_{241} = +4.9 \times 10^{-24}$ cm^2, $\mu_{241}/\mu_{243} = +1.00 \pm 0.01$, $Q_{241}/Q_{243} = +1.00 \pm 0.01$. (auth)

9580

NEUTRON-CAPTURE γ RAYS FROM VARIOUS ELEMENTS. T. H. Braid (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 102, 1109-23(1956) May 15.

Neutron-capture γ-ray spectra have been measured in the energy range 0.3 to 3 Mev by means of a two-crystal Compton scintillation spectrometer. The efficiency of the instrument as a function of energy was determined experimentally. The uniqueness of the 2.23-Mev γ ray following capture of a neutron by hydrogen has been confirmed, and this γ ray was used as a standard to establish the absolute intensity of γ rays from other elements. Most of the γ rays observed can be understood in terms of known levels, and many appear to be emitted in transitions from such levels to the ground state. In many cases, the information obtained complements high-energy data in establishing preferred modes of decay of the product nucleus. In sodium a very strong γ ray is emitted from the first excited state of Na^{24} at 0.47 Mev, and another ground-state γ ray appears to be emitted from the level at 1.34 Mev. The strongest γ ray in the magnesium spectrum is an E1 transition between the levels at 3.41 and 0.58 Mev in Mg^{25}. The aluminum spectrum is very complex, and only a few peaks have been resolved. A ground-state transition is seen from the level at 2.27 Mev in Al^{28}. In silicon two E1 transitions are observed from the capturing level to the levels at 4.93 and 6.38 Mev, and a ground-state transition is seen from the first excited state at 1.28 Mev. Ground-state transitions are observed from the levels at 0.52, 1.15, and 2.18 Mev in P^{32}. In sulfur, there is a strong ground-state γ ray from the first excited state at 0.84 Mev, and a strong E1 transition to this level from that at 2.34 Mev. In chlorine almost all of the observed γ rays can be understood as ground-state transitions from known levels in Cl^{36} at 0.79, 1.16, 1.95, 2.47, and 2.87 Mev. In K^{40} the decay scheme involves several level to level transitions. γ rays to the ground state are observed from the levels at 2.05 and 3.40 Mev in K^{40}, and possibly from the 1.18-Mev level in K^{42}. The spectra from calcium and titanium are very simple. A strong γ ray occurs almost once per capture in Ca^{40} from the 1.95-Mev first excited state of Ca^{41}, and a strong γ ray from the 1.39-Mev first excited state of Ti^{48} occurs almost once per capture in Ti^{48}. In V^{52} most of the observed γ rays are emitted by levels below 1 Mev. Ground-state transitions occur from the levels at 0.42 and 0.83 Mev. In Cr^{54} a very strong γ ray to the ground state is emitted by the level at 0.84 Mev, and a weak transition may be from the 0.54-Mev level in Cr^{53} to the ground state. γ rays to the ground state are observed from levels at 0.42 and 0.88 Mev in Ni^{59}. No definite identification can be made of the four γ rays observed from zinc. The Cd^{114} spectrum contains many unresolved radiations; by far the most intense is the 0.56-Mev γ ray which is emitted from the first excited state. (auth)

9581

DIRECTIONAL CORRELATION OF THE GAMMA RAYS OF La^{140}, Ce^{140}, Pt^{192}, AND As^{75}. W. H. Kelly and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 102, 1130-40(1956) May 15.

The decay scheme of La^{140} was investigated by using summing techniques. This scheme was found to be compatible with a modification of the schemes proposed earlier by other investigators. The 537-kev gamma ray was found to parallel the other transitions. Directional correlation measurements made in the 162-kev to 304-kev cascade do not allow definite spin and multipole order assignment. The following spin sequence (in the order of decreasing energy) appears to be the most probable 1(Q)3(D,Q)4. Ce^{140} was found to have energy levels with spins 0, 2, 4, and 3 in the order of increasing energy. The multipole orders were found to be: 1.600 Mev-quadrupole; 0.490 Mev-quadrupole; 0.328 Mev-dipole with some quadrupole admixture; and 0.815 Mev-dipole with some quadrupole admixture. These assignments are in agreement with those made by other investigators. It was found that the energy levels of Pt^{192} have spins 0, 2, 2, 4 (3 cannot be definitely excluded) in the order of increasing energy. The spins of the fourth and fifth excited states could not be assigned unambiguously but were found to lie in the ranges 2 to 5 and 3 to 5, respectively. Multipole orders of the transitions were assigned as follows: 316 kev-quadrupole; 468 kev-quadrupole (some dipole admixture cannot be definitely excluded); 612 kev-quadrupole; and 296 kev-dipole-quadrupole mixture. These assignments are in rough agreement with those deduced from internal conversion measurements made by other investigators and with previous directional correlation results obtained by other investigators. The results obtained for As^{75} did not allow definite spin and multipole order assignments. However, the measurements permit limits to be placed on the spin assignments. The 281-kev level has spin $^3/_2$ or $^5/_2$ with $^3/_2$ being preferred. The 269-kev level probably has spin $^1/_2$ or $^3/_2$ and the 405-kev state has a spin in the range $^1/_2$ to $^5/_2$ with $^3/_2$ being preferred. (auth)

9582

NEUTRON-CAPTURE CROSS SECTION OF ACTINIUM-227. H. W. Kirby, G. R. Grove, and D. L. Timma (Mound Lab., Miamisburg, Ohio). Phys. Rev. 102, 1140-1(1956) May 15.

In the production of Ac^{227} by thermal neutron irradiation of Ra^{226}, Th^{228} has been recovered as a by-product. The re-

actions involved are: $Ra^{226}(n,\gamma)Ra^{227} \rightarrow Ac^{227} + \beta^-$, and $Ac^{227}(n,\gamma)Ac^{228} \rightarrow Th^{228} + \beta^-$. The thermal neutron capture cross section of Ac^{227} is 495 ± 35 barns, as determined by the pile oscillation method. The half life of Th^{228}, determined by daily alpha counting for two years, is 697.8 ± 0.7 days or 1.910 ± 0.002 year. (auth)

9583

GAMMA RAYS FROM THE PROTON BOMBARDMENT OF SEPARATED COPPER ISOTOPES. C. E. Weller and J. C. Grosskreutz (Univ. of Texas, Austin). Phys. Rev. 102, 1149-56(1956) May 15.

The energy spectrum of γ rays obtained from the proton bombardment of separated copper isotopes has been measured. It was found by coincidence measurements that the majority of these γ rays arise from the capture process when the bombarding energy is held below 2.2 Mev. The thick target cross section for proton capture at 1.9 Mev is found to be 0.1 millibarn. Above 2.2 Mev, excitation of the 0.67-Mev level in Cu^{63} by either inelastic scattering or Coulomb excitation is observed. Excited level schemes for both Zn^{64} and Zn^{66} have been obtained. The first three levels in Zn^{64} are found to be at 0.97, 2.27, and 3.04 Mev. The scheme for Zn^{66} is essentially the same as that earlier proposed from the decay of Ga^{66}. (auth)

9584

MASS OF B^{13} FROM THE NUCLEAR REACTION $Li^7(Li^7,p)B^{13}$. S. K. Allison, P. G. Murphy, and E. Norbeck, Jr. (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 102, 1182-3(1956) May 15.

The preparation of B^{13}, using the reaction $Li^7(Li^7,p)B^{13}$ was studied. A 2-Mev Van de Graaff accelerator was converted for the acceleration of Li ions. The Q-value of the reaction was found to be 5.97 ± 0.03 Mev, and the atomic weight of B^{13} was found to be 13.02190 ± 0.00003. (B.J.H.)

9585

ULTRASONIC SATURATION OF NUCLEAR MAGNETIC ENERGY LEVELS. W. G. Proctor and W. A. Robinson (Univ. of Washington, Seattle). Phys. Rev. 102, 1183-4(1956) May 15.

A change was observed in the population of the nuclear magnetic energy levels of Na^{23} in a single crystal of NaCl as a result of ultrasonic excitation. (B.J.H.)

9586

NUCLEAR SPIN SYSTEM OF LIQUID He^3. Louis Goldstein (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 1205-8(1956) June 1.

The entropy and heat capacity of spin disorder in liquid He^3, obtained previously, define the partial thermodynamic potentials of the spin system. These in turn lead to the spin equation of state. The energy of spin excitation, quadratic in the liquid temperature at low temperatures, tends toward the limiting value of $\frac{1}{2}kT_0$, per spin, at high temperatures, T_0 being the empirical characteristic temperature of the spin system. The partial volume expansion coefficient of liquid He^3, arising from the spin excitations, is a linear function of the temperature at low temperatures and of considerable magnitude, which might make it accessible experimentally. The effect of the spin excitations on the vapor pressure of liquid He^3 might also be separable through a careful analysis of the data over a wide temperature interval. (auth)

9587

NUCLEAR MAGNETIC RESONANCE MEASUREMENTS OF THE ISOTOPES BARIUM-135 AND BARIUM-137. H. E. Walchli (Oak Ridge National Lab., Tenn.) and T. J. Rowland (Electro Metallurgical Co., Niagara Falls, N. Y.). Phys. Rev. 102, 1334(1956) June 1.

By comparison with the nuclear magnetic resonance of Cl^{35}, the nuclear magnetic moments of Ba^{135} and Ba^{137} were found to be 0.832293 ± 0.000025 and 0.931074 ± 0.000055, respectively, without diamagnetic correction. (auth)

9588

STATES OF LOW EXCITATION IN O^{18}. D. R. Bach and P. V. C. Hough (Univ. of Michigan, Ann Arbor). Phys. Rev. 102, 1341-4(1956) June 1.

A new state in O^{18} at an excitation energy of 3.555 ± 0.013 Mev is established by a proton group from the reaction $O^{17}(d,p)$ with Q = 2.262 ± 0.015 Mev and by a deuteron group from the reaction $O^{18}(d,d')$ with Q = −3.551 ± 0.019 Mev. A level reported by Ahnlund at 1.986 ± 0.014 Mev is confirmed. No evidence is found for states between these two, in particular for one reported by Holmgren and coworkers at 2.445 Mev. (auth)

9589

ANOMALY IN ENERGY LEVEL DENSITY MEASUREMENTS. G. Igo and H. E. Wegner (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 1364-5(1956) June 1.

An analysis of nuclear reactions in the intermediate energy range has been made in terms of the statistical theory of nuclear reactions using the Fermi gas level density, const × $\exp[(\alpha E)^{\frac{1}{2}}]$, where E is the energy of excitation. The quantity, α, determined from excitation function experiments and from the (α,p) reaction at 40 Mev shows an anomalous behavior when plotted against atomic number, A. On the other hand, the values of α determined from several inelastic scattering and reaction experiments show the correct dependence on A. The effects of noncompound-nucleus processes are discussed. (auth)

9590

ENERGY LEVELS OF Np^{237} POPULATED BY ALPHA DECAY OF Am^{241}. J. M. Hollander, W. G. Smith, and J. O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 102, 1372-7(1956) June 1.

The conversion electron spectrum following alpha decay of Am^{241} has been reinvestigated with 180° focusing beta-ray spectrographs at ~0.1% resolution. Multipolarity assignments for several gamma transitions are made, principally on the basis of relative L-subshell conversion coefficients. Energy-level spacings and relative transition probabilities are compared and discussed in terms of the Bohr-Mottelson model. The excellent agreement of energy-level spacings with the rotational formula and the general pattern of radiative transitions firmly establish the essentially rotational nature of these bands of levels. However, calculations involving M1 transition probabilities and magnetic moments lead to discrepancies with the simple theory in the case of the ground rotational band. (auth)

9591

OBSERVATION OF NUCLEAR MAGNETIC RESONANCE IN SUPERCONDUCTING MERCURY. F. Reif (Univ. of Chicago). Phys. Rev. 102, 1417-18(1956) June 1.

9592

MULTIPLE IONIZATION IN XENON FOLLOWING INTERNAL CONVERSION. Arthur H. Snell and Frances Pleasonton (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 1419-20(1956) June 1.

Magnetic analysis methods were applied to the stable Xe^{131} atoms that are produced following the isomeric nuclear transition of Xe^{131m}. The resulting distribution in charge is given. (B.J.H.)

9593

GAMMA-GAMMA ANGULAR CORRELATION IN THE DECAY OF ^{48}Sc. B. Van Nooijen, P. Mostert, J. F. Van der Brugge, and P. M. Endt. Physica 22, 194-6(1956) Mar.

Two NaI scintillation spectrometers were used in a fast-slow coincidence arrangement to study the γ-γ angular correlation in the decay of Sc^{48}. It is concluded that the

spin of the 3.35-Mev level is J = 6 and that the 1.04-Mev γ ray is pure quadrupole. (B.J.H.)

9594

EXCITED STATES OF C^{12} IN THE REGION 11 TO 14 MEV. FROM B^{11} (d, n) C^{12} REACTION. Evani Kondaiah (Inst. of Fundamental Research, Bombay). Proc. Indian Acad. Sci. A43, 130-2(1956) Feb.

A separated B^{11} target was bombarded with 1-Mev deuterons from a Cockcroft-Walton accelerator. Nuclear emulsion plates were exposed to the outcoming neutrons at 0° and 90° to the direction of the deuteron beam. The resultant neutron spectra are shown, and data concerning excited states in C^{12} are tabulated. (B.J.H.)

9595

INTERNATIONAL VALUES FOR THE THERMAL CROSS SECTION OF FISSIONABLE ISOTOPES. Soviet Phys. JETP 2, 271(1956) Mar. (In English)

9596

TOTAL CROSS SECTIONS OF NUCLEI OF CERTAIN ELEMENTS FOR NEUTRONS WITH ENERGIES OF 590 MEV. V. P. Dzhelepov, V. I. Satarov, and B. M. Golovin (Inst. for Nuclear Problems). Soviet Phys. JETP 2, 349-51 (1956) Mar. (In English). Zhur. Ekspti.' i Teoret. Fiz. 29, 369-71(1955) Sept. (In Russian)

Neutrons were obtained from the Be(p,n) reaction using 680-Mev protons. Experimental arrangements and results are shown. Total cross sections are reported for protons, deuterons, and complex nuclei such as Be, C, O, Al, Cu, Sn, W, Pb, and U. (B.J.H.)

9597

ISOTOPIC SPIN SELECTION RULES. VI. THE 6.88 MEV STATE OF ^{10}B. D. H. Wilkinson and A. B. Clegg (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 291-7(1956) Mar.

The radiations emitted by the 6.88 Mev level of B^{10} are described and analysed in detail. It is shown that in all probability this state is 1−, T = 0 but that it suffers some tens of per cent contamination by T = 1. It is suggested that this state is formed of Be^9 in its ground state acting as the unique parent for an additional s-wave proton; this very strong contamination could then be due to the presumed near presence of the similarly constituted T = 1 state. (auth)

NUCLEAR REACTORS

9598 AECU-3195

Atomic Power Development Associates, Inc., Detroit.

PROPOSED CONTROL OPERATION PROGRAM FOR THE POWER REACTOR DEVELOPMENT COMPANY FAST BREEDER REACTOR. R. W. Klecker. June 1956. 11p. $0.15(OTS).

The APDA reactor loading, startup, and control are discussed. The methods chosen are believed best for fast breeder reactors. (D.E.B.)

9599 CEA-571

France. Commissariat à L'Énergie Atomique, Paris.

NOUVELLE METHODE DE DETERMINATION DU FACTEUR D'UTILISATION THERMIQUE D'UNE CELLULE. (New Method of the Determination of the Thermal Utilization Factor of a Cell.) A. Amouyal and P. Benoist. Apr. 16, 1956. 36p.

A new formula for the thermal utilization factor is derived, which, while comparable in simplicity to the formula given by elementary diffusion theory, furnishes much more precise results. This is clearly brought out by comparison with the results given by the S_n and spherical harmonics methods. (auth)

9600 DM-38

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

COMMENT ON STUDY BY CORBIN ALLARDICE, ADVISER ON ATOMIC ENERGY, INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT, ENTITLED "ECONOMIC NUCLEAR POWER TODAY: WHERE AND UNDER WHAT CIRCUMSTANCES?" W. B. Lewis. July 10, 1956. 10p.

9601 JENER-43

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ATOMIC PROPULSION OF MERCHANT SHIPS. Progress Report for 1955. Mar. 1956. 22p.

The use of reactors in large tankers was considered from the standpoint of feasibility and economy. Both D_2O and H_2O moderation were studied; D_2O moderation having an apparent advantage. Performance curves were compared for nuclear, oil, and diesel powered 20,000 d.w.t. tankers. These curves, based on a heterogeneous, D_2O moderated reactor, indicate both feasible and economical reactor application. (D.E.B.)

9602 NP-5887(Add.)

Mine Safety Appliances Co., Callery, Penna.

BEHAVIOR OF Na-24 AND Mo-99 AS WATER CONTAMINANTS LEAKING FROM A 550 F, 2000 PSIG SYSTEM. Technical Report No. 46: Addendum. R. J. Campana, H. E. Cummings, and J. W. Mausteller. May 1, 1956. 18p. Contract NObs-65426.

Two additional leak experiments have been made using Na^{24} and Mo^{99} as co-contaminants of a simulated water cooling system of a nuclear reactor. The first run was made at 350 and 550°F to show the effect of H_2O temperature on air contamination. The Mo^{99} air contamination was nearly independent of H_2O temperature while that of Na^{24} changed from a factor of 2 less than Mo^{99} contamination at a H_2O temperature of 350°F to a factor of 3 greater than Mo^{99} contamination at a water temperature of 550°F. The greater Na^{24} air activity occurred at the higher temperature and coincided with a shift to a smaller particle size. Mo^{99} contamination was about the same as found for single isotope contaminated runs. Inactive steam blown into the compartment reduced air contamination by a factor of 8 to 9 within 30 min. The latter run was a steam phase leak, where air contamination was found to be from 100 to 1000 times less than that from comparable liquid phase leaks. Additional conclusions to those cited in Technical Report 46 (NP-5887) are that a lower water temperature depresses the Na^{24} air activity and does not change the Mo^{99} activity; Na^{24} air contamination is higher in mixed isotope runs than when leaked alone; and air activity resulting from a steam phase leak is 100 to 1000 less than from a liquid phase leak. (auth)

9603 ORNL-2121

Oak Ridge National Lab., Tenn.

REMOTE CONTROL OF THE LITR. J. A. Cox, L. C. Oakes, and W. H. Tabor. Aug. 15, 1956. 37p. Contract W-7405-eng-26. $0.30(OTS).

A remote control system has been installed which allows control of both the LITR and Graphite Reactor by one operator in the Graphite Reactor control room. Block diagrams of the system are given, and its operation is discussed. (D.E.B.)

9604 RPI-11(AECL)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE SPECIFICATION OF NEUTRON FLUX AND EFFECTIVE CROSS SECTIONS IN REACTOR CALCULATIONS.

C. H. Westcott. Nov. 1. 1955. (Includes Supplement. Dec. 9, 1955). 15p.

Proposals are made, for presentation at the forth-coming tripartite conference on cross sections and other nuclear data, for the clarification of the basis on which reactor flux values and effective cross sections for thermal and reactor spectra should be calculated. The proposals are slanted from the view point of reactor users rather than designers. (F.S.)

9605 WAPD-CTA(CE)-52

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh]. REVISIONS TO DESIGN BASIS FOR REACTOR VESSELS (WAPD-CE-43). B. F. Langer. Mar. 13, 1956. 9p. (Revisions to WAPD-CE-43.)

9606 WAPD-TM-2

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. ONE-DIMENSIONAL FEW GROUP BURNOUT CODE-ISOTOPIC DENSITY EQUATIONS. G. W. Hoffman. Apr. 1956. 30p. Contract AT-11-1-GEN-14. $0.35(OTS).

The isotopic density equations, or burnout equations, for the one-dimensional few group burnout code are presented in this report. The isotope chains beginning with U^{235}, U^{238} and Th^{232} are presented in detail. The two uranium chains have been described previously for a one-dimensional two group burnout code. Equations for the fission products are presented. I^{135}, Xe^{135}, Pm^{149}, and Sm^{149} are treated explicitly for a few group code. Provision is made for burnable poisons. The equations outlined here are designed for a few group problem which will match into the spatial equations described in WAPD-PM-31. Accordingly, notation consistent with that report is used here. The equations may be adapted to a two, three, or four group scheme. Initially a neutron absorption, fission, or capture cross section must be evaluated for each isotope for each group. (auth)

9607

INDUSTRIAL POWER REACTORS AND THEIR LOCATION. W. Kenneth Davis (U. S. Atomic Energy Commission, Washington, D. C.). Arch. Ind. Health 13, 428-32(1956) May.

General features of nuclear power plants are reviewed. The four reactor experiments being carried out by the AEC at the present time are described. Problems associated with the development of nuclear power are discussed briefly. (C.H.)

9608

NUCLEAR POWER FOR COMMERCIAL VESSELS. I. K. Maddocks (Univ. of Michigan, Ann Arbor). Atomics 7, 151-5 & 166(1956) May.

Following a brief discussion on the principles of fission and reactor operation, five types of reactors suitable for marine use are analyzed. (F. S.)

9609

THE PRESSURISED WATER REACTOR AS A SOURCE OF HEAT FOR STEAM PLANT. IV. J. M. Kay and F. J. Hutchinson. Atomics 7, 157-60(1956) May.

The pressurized water reactor is examined from the viewpoint of the power engineer. Some of the various ways in which it could be employed as a source of heat for a steam power station are considered. (F. S.)

9610

AUTOMATIC START-UP OF NUCLEAR REACTORS. Raymond J. Cox (Atomic Energy Research Establishment, Harwell, Berks, England). I.R.E. Trans. Nuclear Sci. NS-3, No. 1 15-20(1956) Feb.

A system is described for the automatic start-up of a nuclear reactor. This is being used successfully on BEPO. In applying this system to other reactors careful consideration must be given to the noise level and also to the range of neutron fluxes that must be covered. (auth)

9611

SOME REMARKS ON NUCLEAR REACTOR INSTRUMENTATION. J. Walker (Atomic Energy Research Establishment, Harwell, Berks, England). I.R.E. Trans. Nuclear Sci. NS-3, No. 1, 21-5(1956) Feb.

A brief résumé of the safety philosophy for reactors indicating how this affects instrumentation is given. The start up, shutdown, control, and burst slug detection are the parts of the safety system discussed. (F.S.)

9612

FUEL ELEMENT DESIGN. C. E. Weber (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Metals 8, 651-9(1956) May.

Fuel elements are discussed as a generic class without extensive reference to a particular design, considering the interaction of factors which may limit performance. (auth)

9613

A.E.I. RESEARCH REACTOR. Nuclear Eng. 1, 14(1956) Apr.

A swimming pool type reactor MERLIN to be built at Aldermaston for research will be water moderated and shielded, fueled with UO_2(U−20% U^{235}), and Al clad, Cd sheet controlled. (F.S.)

9614

THE WORLD'S REACTORS. NO. 2. CP5—CHICAGO PILE. Nuclear Eng. 1, 62a(1956) May. (This is No. 2 in a series of data sheets on various reactors available from Temple Press Ltd., Bowling Green Lane, London—Price: 4d.($0.10).)

A data sheet consisting of a diagram and specifications for the Argonne Research Reactor is given. (F.S.)

9615

EXPERIMENTAL REACTOR SYSTEMS. PART 2. R. F. Jackson (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Eng. 1, 72-7(1956) May.

The discussion begun in this journal Vol. 1, No. 1 on the zero energy reactor ZEUS, a fast breeder for use in research on fuel enrichment is completed. The following high-flux research reactors provide facilities for the chemist, metallurgist and engineer; GLEEP, an air-cooled graphite-moderated reactor, used in the study of neutron cross sections; BEPO, an air-cooled medium-power reactor, produces radioisotopes; DIDO and PLUTO are heavy water reactors, for isotope production and hot-loop studies; and LIDO, a swimming pool reactor for shielding study. (F.S.)

9616

OUTLOOK FOR A NUCLEAR MERCHANT FLEET. Nucleonics 14, No. 5, 73-6(1956) May.

The feasibility of obtaining a nuclear merchant fleet, particularly the economic feasibility, is discussed. Remarks are included on the advantages of a nuclear ship as opposed to the oil ship. Design problems are briefly discussed, and a conceptual drawing of a nuclear powered tanker is shown. (B.J.H.)

Refer also to abstract 9258.

NUCLEAR TRANSFORMATION

9617 UCRL-3419

California. Univ., Berkeley. Radiation Lab. FISSION OF URANIUM WITH 5.7-BEV PROTONS (thesis). Rex H. Shudde. June 1956. 74p. Contract W-7405-eng-48. $12.30(ph OTS); $4.50(mf OTS).

Uranium was bombarded with 5.7-Bev protons, which are available from the Bevatron at the University of California (Berkeley). The data indicate that the fission process still plays a predominant role in the reactions of uranium with 5.7-Bev protons, although the distribution of fission prod-

ucts is somewhat broader than is observed in the hundred-Mev region. (auth)

9618

ENERGY DISTRIBUTION OF URANIUM AND THORIUM γ-RAY PHOTOFISSION FRAGMENTS. V. A. Korotkova, P. A. Cherenkov, and I. V. Chuvilo (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 106, 811-13(1956) Feb. 11. (In Russian)

Energy spectra of natural mixtures of U isotopes and Th nuclei fission fragments excited by γ-radiation bremsstrahlung at maximum energies of 17.7 Mev were investigated on the Lebedev Inst. of Physics synchrotron. A differential momentum ionization chamber filled with A was used for determining the energies and observing the processes of fission. The electronic component of ionization momenta produced by photofission fragments in the working area of the chamber was used for the recording. The momenta were intensified by a proportional intensifier and was recorded on the film by an oscillograph. The radiotechnical part of installation was similar to the facilities which had been used in previous studies for measuring effective photofission cross sections. The provisional selective scheme recorded only the energies which occurred at the moment of γ beam passage through the ionization camera. A wire-gauze electrode was installed in front of the collecting electrode of the chamber. The calculation effectiveness of screening by the wire-gauze electrode was about 96%. The results of experiments with U and Th photofission are quantitatively analogous to the data obtained in studies of neutron fission. (R.V.J.)

9619

STUDY OF THE REACTIONS $Ge^{70}(\gamma,n)Ge^{69}$ AND $Ge^{76}(\gamma,n)Ge^{75}$. Ottavia A. Borello, José Goldemberg, and Marcello D. S. Santos (Universidade de Sao Paulo, Brazil). Anais acad. brasil. cienc. 27, No. 4, 413-15(1955). (In Portuguese)

9620

STUDY OF THE REACTIONS $K^{39}(\gamma,n)K^{38}$ AND $Cl(\gamma,n)Cl^{34}$. Ottavia A. Borello, José Goldemberg, and Marcello D. S. Santos (Universidade de Sao Paulo, Brazil). Anais acad. brasil. cienc. 27, No. 4, 417-25(1955). (In Portuguese)

9621

STUDY OF (γ,d) AND (γ,np) REACTIONS IN SEVERAL ELEMENTS. Suzanna dow Santos Villaca and José Goldemberg (Universidade de Sao Paulo, Brazil). Anais acad. brasil. cienc. 27, No. 4, 427-35(1955). (In Portuguese)

9622

POLARIZATION OF THE PROTONS FROM THE REACTION $C^{12}(p,p)C^{12}$. P. S. de Toledo and Shigeo Watanabe (Universidade de Sao Paulo, Brazil). Anais acad. brasil. cienc. 27, No. 4, 471-7(1955). (In Portuguese)

9623

ANGULAR DISTRIBUTIONS WITH HIGH ENERGY RESOLUTION: LONG-RANGE GROUPS FROM $O^{18}(d,p)O^{19}$. Katarina Ahnlund. Arkiv Fysik 10, No. 5, 425-30(1956)

The O^{18} targets were prepared by electromagnetic separation of H_2O 25 times enriched in O^{18}. The targets were bombarded with deuterons, and the resulting protons were detected in Ilford C2 nuclear emulsions. Resultant angular distributions of the proton groups are shown in graphical form. The sources of error are briefly discussed. (B.J.H.)

9624

FORM OF THE PHOTOPROTON SPECTRUM FROM THE REACTION $Cu(\gamma,p)Ni$ USING MONOCHROMATIC γ RAYS. Raymond Chastel. Compt. rend. 242, 2337-40(1956) May 7. (In French)

The forms of photoproton spectra obtained experimentally in photographic emulsions are compared to the theoretical forms calculated by the evaporation model. For the γ radiations used, the photoproton excess resulting from the direct photonuclear effect is between 3 and 9%. (tr-auth)

9625

NITROGEN-INDUCED NUCLEAR REACTIONS IN ALUMINUM. W. H. Webb, H. L. Reynolds, and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 749-52(1956) May 1.

Aluminum foils were bombarded with 25.5-Mev nitrogen ions from the Oak Ridge National Laboratory 63-inch cyclotron, and the following radioactive reaction products were separated chemically and identified: C^{11}, N^{13}, F^{18}, Na^{24}, Cl^{38}, K^{38}, and P^{32}. The deflected cyclotron beam was used to study the cross sections for the three reactions, $Al^{27}(N^{14}, N^{13})Al^{28}$, $Al^{27}(N^{14}, 3p)Cl^{38}$, and $Al^{27}(N^{14}, p2n)K^{38}$, for energies from 19.5 to 25.5 Mev. It was found that over this energy range the cross section for the $(N^{14}, p2n)$ reaction is about fifty times greater than for the $(N^{14}, 3p)$ reaction, as would be expected from the statistical theory for the decay of the compound nucleus. A search was made for Si^{31} and Mg^{27}. The upper limits for the respective yields are 3×10^{-11} and 9×10^{-11} nuclei formed per incident particle at 25.5 Mev. The range-energy relation for nitrogen ions in aluminum was measured. (auth)

9626

PROMPT NEUTRONS FROM THE SPONTANEOUS FISSION OF FERMIUM-254. Gregory R. Choppin, Bernard G. Harvey, Donald A. Hicks, John Ise, Jr., and Robert V. Pyle (Univ. of California, Berkeley). Phys. Rev. 102, 766(1956) May 1.

The average number of prompt neutrons emitted during the spontaneous fission of Fm^{254} has been measured to be 4.05 ± 0.19 (standard error). (auth)

9627

SPONTANEOUS FISSION KINETICS OF Cf^{252}. A. B. Smith, A. M. Friedman, and P. R. Fields (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 813-15(1956) May 1.

A double ionization chamber is used to determine the spontaneous fission modes of $Cf^{252}[\tau_{\frac{1}{2}}$ (fission) = 66 years]. The most probable energies of the light and heavy fragments are measured to be 107 and 79 Mev, respectively. The asymmetry of the process is found to agree with chemical mass-yield determinations. The results of the experiment are compared with the kinetics of other fission processes. (auth)

9628

POLARIZATION OF THE DEUTERON IN THE REACTION $p + p \rightarrow \pi^+ + d$. Robert D. Tripp (Univ. of California, Berkeley). Phys. Rev. 102, 862-6(1956) May 1.

Using 340-Mev unpolarized protons, the polarization of deuterons produced at a c.m. angle of 115° in the $p + p \rightarrow \pi^+ + d$ reaction has been measured. The deuterons were detected in coincidence with the mesons and were analyzed by scattering from a carbon target at 24°. In conjunction with previous experiments on the reaction, this measurement completes the specification of the phenomenological parameters of Rosenfeld and Gell-Mann and Watson. Specifically it permits the determination of the relative phases of the several modes of meson production, which in turn are related to the p−p phase shifts at this energy. (auth)

9629

ANGULAR DISTRIBUTION OF NEUTRONS FROM THE $Be^9(\gamma,n)Be^8$ REACTION. W. Czyż (Jagiellonian Univ., Cracow, Poland). Phys. Rev. 102, 1185(1956) May 15.

It is suggested that the incoherent addition of the angular distributions of the dominant transitions in the reaction $Be^9(\gamma,n)Be^8$ is not justified. Supporting calculations are outlined. (B.J.H.)

9630

FISSION OF BISMUTH WITH 15- AND 22-MEV DEUTERONS.

A. W. Fairhall (Univ. of Washington, Seattle). Phys. Rev. 102, 1335-40(1956) June 1.

Radiochemical studies of bismuth bombarded with 15- and 22-Mev deuterons give evidence of fission product species, clearly distinguishable from species arising from activation of target impurities. The mass-yield curve of fission products from bismuth bombarded with 22-Mev deuterons is unlike the double-humped curves of the heavier elements ($Z \geq 90$) excited to comparable energies: it is single humped, symmetric about mass 103.5 and quite narrow. The width of the curve at half-maximum is only 17 mass units. The cross sections for fission of bismuth by 20-Mev deuterons is estimated to be about 1×10^{-29} cm^2, and for 15-Mev deuterons about 4×10^{-31} cm^2. The competition between fission and neutron evaporation in high-energy fission is discussed. (auth)

9631

NEUTRONS AND GAMMA RAYS FROM THE ALPHA-PARTICLE BOMBARDMENT OF Be^9, B^{10}, B^{11}, C^{13}, AND O^{18}. T. W. Bonner, Alfred A. Kraus, Jr., J. B. Marion, and J. P. Schiffer (Rice Inst., Houston, Tex.). Phys. Rev. 102, 1348-54(1956) June 1.

Excitation curves at 0° and 90° were studied for neutrons and γ rays produced in bombardment of thin targets of Be^9, B^{10}, B^{11}, C^{13}, and O^{18} by α particles with energies of from 1.8 to 5.3 Mev. Resonances were observed in the $Be^9(\alpha,n)C^{12}$ reaction at bombarding energies of 1.9, 2.3, 2.6, 3.98, 4.4, and 5.0 Mev. The $C^{13}(\alpha,n)O^{16}$ reaction showed resonances at 2.09, 2.25, 2.42, 2.605, 2.69, 2.775, 2.825, 3.09, 3.33, 3.42, 3.67, 3.73, 4.125, 4.42, 4.50, 4.63, 4.75, and 5.05 Mev. The $B^{10}(\alpha,n)N^{13}$ excitation curve has resonances at 2.16, 2.25, 2.90, 4.53, 4.85, and 5.36 Mev, while the γ-ray yield from the $B^{10}(\alpha,p\gamma)C^{13}$ reaction showed all these as well as resonances at 3.6 and 3.95 Mev. The $B^{11}(\alpha,n)C^{13}$ reaction has resonances at bombarding energies of 2.06, 2.60, 2.93, 2.97, 3.23, 3.54, 3.72, 3.92, 4.25, 4.34, and 5.00 Mev. The $O^{18}(\alpha,n)Ne^{21}$ reaction was studied with a thicker target (90 to 130 kev). Resonances in the neutron yield were resolved at 2.21, 2.47, 2.57, 2.72, 2.94, 3.24, 3.63, 3.91, 4.12, 4.22, 4.33, 4.52, and 4.82 Mev. Cross sections and widths of the resonances in the various reactions were determined. (auth)

9632

COMPOUND NUCLEUS EFFECTS IN DEUTERON REACTIONS: $C^{13}(d,\alpha)B^{11}$ AND $C^{13}(d,t)C^{12}$. Jerry B. Marion and Gustav Weber (California Inst. of Tech., Pasadena). Phys. Rev. 102, 1355-64(1956) June 1.

Excitation functions for the $C^{13}(d,\alpha)B^{11}$ and $C^{13}(d,t)C^{12}$ reactions have been measured at several laboratory angles in the range of deuteron energy from 1 to 3 Mev. Two prominent resonances were observed in the (d,α) reaction at 1.80 Mev ($\Gamma = 55 \pm 10$ kev) and at 2.20 Mev ($\Gamma = 22 \pm 4$ kev). The latter resonance was observed at 14 angles of observation from 25° to 140°. The 1.80-Mev resonance was observed at 9 angles in the (d,α) reaction and at 3 angles in the (d,t) reaction. The 2.20-Mev resonance was not found in the (d,t) reaction, but the α-particle group leaving B^{11} in the first excited state was observed to be resonant at this energy. Both of the narrow resonances exhibit striking interference effects with the nonresonant background. An analysis of the interference effects at the 2.20-Mev resonance indicates that deuterons with 3 or 4 units of angular momentum are responsible for the formation of the corresponding N^{15} level. The differential cross section for the (d,α) reaction was measured at 17 angles from 11.2° to 144.6° (c.m.) at $E_d = 2.28$ Mev. Terms at least as high as $\cos^4\theta$ are necessary to fit the forward peak. This forward peaking in the (d,α) reaction persists over the entire energy range studied in spite of the large number of resonances in this region. This behavior suggests that some of the approximations usually made in the theory of highly excited states of nuclei are not of general validity. (auth)

9633

REACTION $Al^{27}(p,3pn)Na^{24}$. H. G. Hicks, P. C. Stevenson, and W. E. Nervik (Univ. of California, Livermore). Phys. Rev. 102, 1390-2(1956) June 1.

The cross section for the reaction $Al^{27}(p,3pn)Na^{24}$ has been measured as a function of proton energy between 32 and 350 Mev by comparison with the cross section of the reaction $C^{12}(p,pn)C^{11}$. (auth)

9634

PION PRODUCTION BY INELASTIC SCATTERING OF ELECTRONS IN HYDROGEN. W. K. H. Panofsky, W. W. Woodward, and G. B. Yodh (Stanford Univ., Calif.). Phys. Rev. 102, 1392-8(1956) June 1.

The ratios of the yield of electron-induced to photon-induced pion processes have been measured at an incident energy of 600 Mev. Measurements have been made at energies of 60 and 170 Mev for positive pions. The result is expressed in terms of "the equivalent radiation length" X_e defined so that the pion yield due to direct electron production is equal to the pion yield due to photons produced by electrons in a radiator of X_e radiation lengths. The results are $X_e = 0.0191 \pm 0.0011$ for 60-Mev pions and $X_e = 0.0178 \pm 0.0023$ for 170-Mev pions. At the lower pion energy the value is somewhat lower than the theoretical value if equal transverse and longitudinal interactions are assumed. If the contribution from the longitudinal matrix element is taken to be small or if the electron contribution from large angles of electron scattering is suppressed, then the value can be fitted. The value at 170 Mev is in agreement with predominantly magneticdipole absorption corresponding to the enhanced $P_{3/2,3/2}$ state of the final pion-nucleon system. (auth)

9635

NUCLEAR DISINTEGRATIONS PRODUCED IN NUCLEAR EMULSIONS BY α-PARTICLES OF GREAT ENERGY. M. V. K. Appa Rao, R. R. Daniel, and K. A. Neelakantan (Tata Inst. of Fundamental Research, Bombay), Proc. Indian Acad. Sci. A43, 181-201(1956) Mar.

A study of nuclear disintegrations caused by α particles in primary cosmic radiation with energies > 5 Bev per nucleon, has been carried out. In a systematic survey in nuclear emulsions using 'along the track' scanning methods, 479 α particles with a total track length of 40.84 meters and 242 interactions were obtained. From the angular distribution of shower particles associated with these interactions, a procedure has been found for distinguishing protons, which originally formed part of the incident α particle and which have not taken part in the interaction, from other charged particles. The mean free path for nuclear interaction in G-5 emulsion is found to be 17.5 ± 1.1 cm (68.9 ± 4.3 gm/cm^2). Assigning to both the incident α particle and to the target nuclei a radius $R = r_0 A^{1/3}$, one obtains an effective nuclear radius $r_0 = 1.13 \pm 0.04 \times 10^{-13}$ cm. Using the number of protons emerging from disintegrations of heavy nuclei (Ag and Br) without having participated in the interaction (as can be deduced from the angular distribution) and assuming spherical nuclei of uniform density, the mean free path of nucleons in nuclear matter is calculated to be less than 3.2×10^{-13} cm. (auth)

9636

DELAYED NEUTRONS WHICH ACCOMPANY PHOTOFISSION OF URANIUM AND THORIUM. L. E. Lazareva, B. S. Ratner, and I. V. Shtranikh (P. N. Lebedev Inst. of Physics). Soviet Phys. JETP 2, 201-6(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 274-9(1955) Sept. (In Russian)

Decay curves and yield were obtained from delayed neutron radiation accompanying the photofission of uranium

and thorium. The delayed neutrons represent 0.41 ± 0.02% and 0.18 ± 0.01%, respectively, of all the neutrons emitted in photofission of uranium and thorium. (auth)

9637

REACTIONS IN LIGHT NUCLEI. II. P. J. Grant (Univ. of Glasgow, Scotland). Atomics 7, 161-6(1956) May.

Emphasis in the field of light nuclear reactions is on experiments of the characteristic properties of the nuclear energy-levels such as the radiation width, spin, parity, and isotopic spin, together with the discovery and testing of selection rules for nuclear transitions. (F. S.)

9638

DETERMINATION OF ABSOLUTE CROSS-SECTION ON (n,p) REACTION IN S^{32}. N. K. Saha and L. Kasturi Rangan (Univ. of Delhi). Indian J. Phys. 30, 80-90(1956) Feb.

The absolute cross-section of (n,p) reactions in S^{32} has been determined by measuring the activity of P^{32} produced by fast neutrons from a 95 mg (Ra–Be) source, under cylindrical geometry. The various corrections involved are taken into account. The counter efficiency is determined as (4.7 ± 0.5) % by means of a calibrated end-window counter and a thin layer of chemically separated P^{32} of high specific activity. An average value of $\bar{\sigma}_{n,p}$ = 150 ± 37 mb is obtained, which compares reasonably well with the estimated value from other workers' results. (auth)

Refer also to abstracts 9467, 9497, and 9495.

PARTICLE ACCELERATORS

9639 UCRL-1865

California. Univ., Berkeley. Radiation Lab.
CONSIDERATIONS ON THE EFFECT OF BEAM-DEE COUPLING IN A CYCLOTRON RF SYSTEM. L. F. Wouters. July 14, 1952. Decl. June 11, 1956. 46p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The electrical equivalence of the beam as a load impedance across the r-f generator driving the cyclotron dee is discussed. The magnitude and phase components are derived. The purely resistive loading effects occurring at exact resonance are considered. Graphical representations are developed and interpreted which attempt to correlate the operating parameters of the complete machine. A prediction of the range of impedance presented to the r-f generator is developed. The possible reactive effects of large beam currents in mitigating or aggravating the mistuning of a dee resonant system are considered. (L.M.T.)

9640

APPLICATION OF CERAMIC SECTIONS IN HIGH-POWER PULSED KLYSTRONS. Louis H. La Forge, Jr. (W. W. Hansen Labs. of Phys., Stanford, Calif.). Am. Ceram. Soc. Bull. 35, 117-22(1956) Mar.

Early work with klystron tubes for the Stanford linear accelerators showed the need for r-f windows of material having better electrical and mechanical properties than those of glasses. Several ceramic bodies in a variety of shapes and sizes were tried on these klystrons which handle peak powers up to 30 megawatts at microwave frequencies. High-alumina compositions proved superior to other formulations for these applications. Currently several metallizing techniques are in use, with one basic modification of the Mo–Mn method being of broad usability. This modified Mo–Mn system is especially efficacious on materials of high refractoriness, working well even on sapphire. Suitable brazing materials permit direct soldering of the metallized surfaces without the intervening step of nickel plating or its equivalent. (auth)

9641

CONSTRUCTION OF A 700 KEV ION ACCELERATOR TUBE. DEVELOPMENT OF OSCILLATING ELECTRON ION SOURCES. J. Sommeria-Klein. Ann. phys. (13) 1, 344-94(1956) Mar.-Apr. (In French)

9642

ON SOME PROCESSES OF ELECTRON ACCELERATION IN A MICROTRON. E. M. Moroz. Doklady Akad. Nauk S.S.S.R. 106, 986-8(1956) Feb. 21. (In Russian)

Microtron-resonance particle acceleration in constant magnetic and constant-frequency electric fields was proposed by V. I. Veksler, in which particles passing through the acceleration interval of oscillators acquire an equal or multiple energy $\Delta E = e\lambda H/2\pi$, which is considered the resonance portion of the energy (e is the electron charge, and λ is the wave length in vacuum, corresponding to the electric field end-vibrator frequency). With the successive passages through the oscillator acceleration interval, the equilibrium particles meet the same electric field phase ϕ which can be found in expression $2\pi V\cos\phi\lambda H = N$, where V is the amplitude of potential difference, applied to the acceleration slit, N is the total number. Thus, the obtained condition $a = 2\pi V > 1/\lambda H$ demands the application of small values of H which in turn demands large installations and limits the possible amount of energy. A. A. Kolomenskiĭ was the first to investigate the phase microtron equation. Subsequently theoretical and experimental works were dedicated to the investigation of the acceleration process. Studies have been made of other acceleration processes which are not limited by the condition of $a = 2\pi V/\lambda H$. (R.V.J.)

9643

AN APPROXIMATE METHOD FOR OBTAINING THE VSW ON CYCLOTRON DEES. M. R. Donaldson (Oak Ridge National Lab., Tenn.). I.R.E. Trans. Nuclear Sci. NS-3, No. 2, 1-4(1956) Mar.

In the design of cyclotron resonant systems, the voltage distribution along the accelerating electrodes (dees) is frequently desired. This paper describes an approximate method for obtaining this vsw. An experimental check of the method is included. In addition, data on Oak Ridge National Laboratory Cyclotrons are presented. (auth)

9644

PROTON BEAM STUDY IN A FIXED-FREQUENCY CYCLOTRON. F. L. Green (General Motors Central Research Lab., Detroit). I.R.E. Trans. Nuclear Sci. NS-3, No. 2, 8-11(1956) Mar.

Operational and theoretical experience with the ORNL 44- and 63-inch cyclotrons is used in estimating the time variation of proton beam current passing through the r-f field between the dees of the ORNL 44-inch cyclotron. The proton current appears to have a significant reactive component. This result is probably typical of most fixed frequency cyclotrons whose ions make 30 to 100 orbits in being accelerated to maximum radius. The study is briefly related to problems which may be encountered in the design of a fixed-frequency r-f system capable of accelerating hundreds of kilowatts of ions to be used for a purpose such as the production of radioisotopes. (auth)

9645

THE MICROTRON, A NUCLEAR AND ELECTRONIC RESEARCH INSTRUMENT. H. F. Kaiser (Naval Research Lab., Washington, D. C.). I.R.E. Trans. Nuclear Sci. NS-3, No. 2, 17-27(1956) Mar.

The microtron is one of the simplest electron cyclotrons with a cavity resonator which produces and accelerates electrons and a suitable uniform stationary magnetic field which guides them in a set of cotangential circular orbits. Its development and potentialities in various fields of nuclear and electronic research are discussed. (F.S.)

9646
STORAGE RING SYNCHROTRON: DEVICE FOR HIGH-ENERGY PHYSICS RESEARCH. Gerard K. O'Neill (Princeton Univ., N. J.). Phys. Rev. 102, 1418-19(1956) June 1.

A scheme is suggested for a synchrotron system which would have the same advantages as a system of two fixed-field alternating gradient accelerators. The system utilizes two "storage rings", focusing magnets containing straight sections one of which is common to both rings. The possibilities of storing a number of beam pulses in the rings are discussed in some detail. (B.J.H.)

RADIATION ABSORPTION AND SCATTERING

9647 CRLR-502
Chemical and Radiological Labs., Army Chemical Center, Md.
APPLICATIONS OF INFINITE PLANE THEORY OF GAMMA SCATTERING. Ralph Fullwood, Sam Holland, Richard Liboff, and Paul Grant. Mar. 5, 1956. 25p. Project 4-12-10-007-04.

Work is reported on the following problems in the theory of gamma scattering from an infinite plane source: the dose rate as a function of energy at 3 ft. above the plane, the dose rate as a function of height above the plane for source energies of 1 and 2.76 Mev, the dose rate as a function of the radius of contamination for 3 source energies (1, 2, and 3 Mev) and the dose rate received 3 ft. below the surface in a hole 3 ft. in diameter for a source of 1 Mev. (auth)

9648 ORNL-2137
Oak Ridge National Lab., Tenn.
SPATIAL DISTRIBUTION OF ELECTRON DEPTH DOSE IN ALUMINUM. Fred N. Huffman. Aug. 15, 1956. 79p. Contract W-7405-eng-26. $0.45(OTS).

The Spencer theory of electron penetration is experimentally checked for 25 to 125 kev electrons incident on Al. Measurements were made using an electron accelerator and an especially designed triple plate ionization chamber. The Spencer theory is reviewed, the triple plate ionization chamber design and operation is given, and the measurement results are presented and discussed. (D.E.B.)

9649 UCRL-3412
California. Univ., Berkeley. Radiation Lab.
EXPERIMENTS ON POLARIZATION IN SCATTERING DEUTERONS FROM COMPLEX NUCLEI AND IN PROTON-PROTON SCATTERING (thesis). John A. Baldwin, Jr. May 11, 1956. 64p. Contract W-7405-eng-48. $10.80(ph OTS); $3.90(mf OTS).

The elastic double scattering of deuterons by complex nuclei has been investigated experimentally. Measurements were made on C, Al, and Cu at around 157 Mev; on Li, Be, and C at around 125 Mev; and on C and Al at 94 Mev. The expected tensor components of the deuteron polarization have not been observed. Measurements have been made of the differential cross section and vector-type polarization as a function of angle for the scattering of deuterons from the above elements, at the above energies. The observed polarizations were larger than would be expected on the basis of the individual nucleon-nucleus interactions. In a second experiment the 169-Mev proton-proton polarization was measured at 10, 15, 22.5, 30, and 35° in the laboratory system. The results indicate that partial waves up to and including L = 3 are important at this energy. (auth)

9650 WAL-842/56
Watertown Arsenal Labs., Mass.
AN EQUATION FOR THE SELF ABSORPTION OF BETA AND GAMMA RAYS. Arthur Kant. June 25, 1956. 14p. D/A Project No. 599-01-004.

Self absorption relationships for an exponential absorber under conditions of spherical beam geometry are developed. It is shown that the relationships between activity and thickness of the self absorber are quite different from those obtained under the assumption of parallel beam geometry. Self absorption of the beta rays from C^{14} in the absence of external absorbers (including counter window) follows the law of exponential absorption and spherical beam geometry. (auth)

9651
RANGE-ENERGY RELATION FOR PROTONS IN ILFORD C-2 EMULSION. J. Catalá, E. Villar, A. Bonet, and L. Miralles. Anales real soc. espan. fís. y quim. (Madrid), Ser. A 52, 85-92(1956) Mar.-Apr. (In Spanish)

The 19-Mev deuteron beam from the Birmingham cyclotron has been used to produce protons by the $C^{12}(d, p)C^{13}$ reaction. The measurements of ranges of protons corresponding both to the C^{13} ground state and those elastically scattered by the bombarding deuterons, in Ilford C-2 dry plates, have given new points for the range-energy relation, between 15 and 21.5 Mev. Starting from the experimental relation these results were checked with those of other investigators. (auth)

9652
EFFECTIVE ABSORPTION CROSS SECTIONS FOR 0.95 BEV PROTONS IN THE HEAVY AND LIGHT NUCLEI OF PHOTOGRAPHIC EMULSIONS. Georges Philbert. Compt. rend. 242, 2547-50(1956) May 23. (In French)

The values of the mean free paths of 1-Bev protons in normal and diluted G-5 emulsions allow the determination of effective reaction cross sections with light (C,N,O) and heavy (Br,Ag) nuclei. (tr-auth)

9653
ON DIFFRACTION SCATTERING OF FAST DEUTERONS BY NUCLEI. A. I. Akhiezer and A. G. Sitenko (Gor'kiĭ Kharkov State Univ.) Doklady Akad. Nauk S.S.S.R. 107, 385-8(1956) Mar. 21. (In Russian)

The absorption of particles by scattering nuclei induces an additional turbulence in the falling wave which, in turn, creates an elastic scattering not connected to the formation of the component nucleus. Such elastic scattering caused by the absorbing scattering force in the case of the falling particle short wave is analogous to light diffraction from an absolutely black sphere and is named diffraction scattering. Analytical studies are made to show the possibility of adapting generalized optical methods for investigation of diffraction scattering of complex particles. A simple problem of diffraction scattering of elementary particles by absorbing nuclei, considered absolutely black, is taken as the first example. The equations obtained, permit generalization of the cases of complex particle diffraction scatterings. Elastic diffraction scatterings of deuterons are investigated. Deuteron diffraction splitting and the total cross section of elastic scattering and absorption are determined. (R.V.J.)

9654
IONISATION LOSS OF α-PARTICLES AT LOW ENERGIES BELOW 4 MEV. K. L. Kaila (Univ. of Delhi). Indian J. Phys. 29, 479-89(1955) Oct.

No quantitative theory seems to have been given so far for the ionization loss of α particles at energies below 4 Mev due to the extremely complicated phenomenon of electron capture by the α particle occurring in this region. An

attempt is made to get a complete expression for the ionization loss of α particles in this region by transforming Bethe's theoretical expression (which is valid only at high energies) and introducing some new terms to take account of electron capture and finally fitting it empirically with the well known Holloway and Livingston single α ionization curve. A theoretical interpretation of the new form of the relation has also been given. Further, using this new expression an empirical range energy relation is obtained which gives quite satisfactory agreement with the observed range-energy relation of α particles in the region 2.5 Mev downwards. (auth)

9655

INVESTIGATION OF ROENTGEN SPECTRA IN Mn–Ni ALLOYS. V. A. Kazantsev (Kuĭbyshev Industrial Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 107-12(1956) Jan.

Behavior of emission $K\beta_5$ bands and other bands of the $K\beta$ group in Mn and Ni spectra during magnetic conversions of Mn–Ni alloys has been investigated. Results showed that magnetic conversions taking place during the changes in alloy content as well as in transitions through the curie point (which are quite dissimilar factors) produce a similar effect on the behavior of $K\beta_5$ band emissions in Mn and Ni atoms. Transitions of alloys into paramagnetic state is accompanied by Ni $K\beta_5$ band shift to the side of larger energies while the $K\beta_5$ bands of Mn shift to the side of smaller energies. The magnetic transformation also affects the form, width and intensities of $K\beta_5$ bands of both components. The analyzed data proved to be insufficient for determination of spectra behavior in both magnetic conversions of alloys. Studies were made of Mn K-boundary and Ni K-boundary absorption. (R.V.J.)

9656

ELASTIC SCATTERING OF 188-MEV ELECTRONS FROM THE PROTON AND THE ALPHA PARTICLE. R. W. McAllister and R. Hofstadter (Stanford Univ., Calif.). Phys. Rev. 102, 851-6(1956) May 1.

The elastic scattering of 188-Mev electrons from gaseous targets of H and He has been studied. Elastic profiles have been obtained at laboratory angles between 35° and 138°. The areas under such curves, within energy limits of ±1.5 Mev of the peak, have been measured and the results plotted against angle. In the case of hydrogen, a comparison has been made with the theoretical predictions of the Mott formula for elastic scattering and also with a modified Mott formula (due to Rosenbluth) taking into account both the anomalous magnetic moment of the proton and a finite size effect. The comparison shows that a finite size of the proton will account for the results and the present experiment fixes this size. The root-mean-square radii of charge and magnetic moment are each $(0.74 \pm 0.24) \times 10^{-13}$ cm. In obtaining these results, it is assumed that the usual laws of electromagnetic interaction and the Coulomb law are valid at distances less than 10^{-13} cm and that the charge and moment radii are equal. In helium, large effects of the finite size of the alpha-particle are observed and the rms radius of the alpha particle is found to be $(1.6 \pm 0.1) \times 10^{-13}$ cm. (auth)

9657

INTERPRETATION OF THE PHASE SHIFTS IN PION-NUCLEON SCATTERING. R. G. Sachs (Princeton Univ., N. J.). Phys. Rev. 102, 867-70(1956) May 1.

Wigner has shown that there is a lower limit on the derivative of the scattering phase shift with respect to energy, the limit being expressed in terms of the range of the interaction. Orear has pointed out that this condition is not satisfied by the pion-nucleon S-wave phase shifts given by Bethe and de Hoffmann for energies near 200 Mev. Orear's alternate solution, satisfying Wigner's criterion, fits the data equally well. The use of the Wigner condition for pion-nucleon scattering is somewhat questionable because the concept of interaction radius is not well defined. It is shown here that a similar condition may be obtained without the use of this concept. Orear's argument is strengthened on this basis. A simple interpretation of the S-wave phase shifts is given in terms of an $I = \frac{1}{2}$ resonance at very high energy, the only parameter being the ratio of level width to resonance energy. A simple two-parameter interpretation of the P-wave phase is also presented. (auth)

9658

NUCLEON-NUCLEON SCATTERING. Herman Feshbach (Massachusetts Inst. of Tech., Cambridge) and Earle Lomon (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 102, 891-904(1956) May 1.

Nucleon-nucleon scattering data from 0 to 274 Mev are discussed by means of a boundary-condition approximation. For internucleon distances greater than the core radius, which may depend on the state under discussion, the nucleon-nucleon interaction is assumed to vanish, while at the core radius the logarithmic derivative of the wave function or the reaction matrix satisfies a boundary condition. Assuming charge independence, it has been found possible to fit most of the experimental data with all but one boundary condition energy-independent. The core radius for the $^1S_0$ state is assumed to decrease with increasing energy. It was found that p–p scattering is composed mostly of scattering in the $^1S_0$ and $^3P_0$ states, both of which give isotropic distributions. The scattering from the $^3P_0$ state is close to the scattering by a repulsive sphere of radius 1.32×10^{-13} cm. The scattering in the isotopic singlet state below 100 Mev, assuming that the n–p angular distribution is symmetric about 90°, is entirely determined by the low-energy fit to triplet ($^3S_1 + {}^3D_1$) n–p scattering. Above 100 Mev the ($^3S_1 + {}^3D_1$) states make the major contribution to the isotopic singlet scattering. The predicted cross sections fail significantly in only one detail: they are not sufficiently large for n–p scattering near 180°. Regardless of the validity of this particular fit, the boundary-condition approximation is found to provide a comparatively simple method for the broad correlation and understanding of the experimental results. (auth)

9659

NUCLEON SCATTERING AND THE FESHBACH-LOMON MODEL. Robert B. Raphael (Univ. of California, Berkeley). Phys. Rev. 102, 905-13(1956) May.

A method, based upon the results of Feshbach and Lomon, is established by which a given potential may be simply tested for its capability of providing an adequate charge-independent description of nucleon-nucleon scattering to 300 Mev. The view is taken that the scattering is better represented by replacing the (in general) strongly energy-dependent scattering phase shifts with a set of suitably defined logarithmic derivatives Γ_{JL}. These, when evaluated at a "characteristic interaction distance" $\bar{r}$, will depend at most weakly upon energy. The success of the Feshbach-Lomon (FL) model in the interval 0 to 300 Mev is here regarded more generally as establishing this view in the above energy range. These ideas are given their mathematical formulation through a generalization of effective-range methods familiar in low-energy scattering. Here $\bar{r}$, which plays the role of an effective range, is shown by means of stationary expressions for Γ_{JL} to attain a state-independent value equal to the FL "core" radius, provided that Γ_{JL} has the desired weak energy dependence. It is then only necessary to find the behavior with energy of the parameters Γ_{JL}, as determined by a given potential, in order to test whether or not the latter is capable of giving a charge-independent description of the scattering. The method is illustrated in singlet S-states with two-parameter monotonic static potentials. It is found that Gaussian, exponential, and Yukawa potentials are not consistent with the analysis unless these

potentials also contain a repulsive core whose radius is suitably restricted. A rectangular potential is barely possible because of the uncertainties in the FL fit arising from insufficient experimental data. An appendix is devoted to a discussion of the variational principle used in the text. (auth)

9660

DISPERSION RELATIONS FOR PION-NUCLEON SCATTERING: NO-SPIN-FLIP AMPLITUDE. Reinhard Oehme (Univ. of Chicago). Phys. Rev. 102, 1174-80(1956) May 15.

It is shown that the principle of microscopic causality is sufficient and in general also necessary for the existence of dispersion relations for the derivatives of the no-spin-flip amplitude with respect to $\cos\varphi$, taken at zero angle. Physical dispersion relations are derived for these quantities, neglecting the nucleon recoil. The dispersion formulas for the first derivative reduce to the no-spin-flip parts of Low's P-wave equations, if one neglects in addition to the recoil all inelastic processes and contributions from partial waves with $l > 1$. In combination with corresponding approximate relations, obtained from the exact dispersion formulas for the forward scattering amplitude, one can derive integral equations for S-waves only. The inhomogeneous terms of these equations contain the zero-energy scattering lengths. Finally, it is shown that in general one cannot derive normal dispersion relations for the amplitudes corresponding to individual angular momenta. (auth)

9661

ELASTIC SCATTERING OF NITROGEN BY NITROGEN. H. L. Reynolds and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 1378-84(1956) June 1.

The differential cross section for the elastic scattering of nitrogen from nitrogen was measured for incident nitrogen laboratory energies of 15.0, 17.7, 19.2, and 21.7 Mev and laboratory angles from 15° to 55°. The scattering occurred in nitrogen gas and the particles were detected with a nuclear emulsion placed in a one-slit camera. At 15 Mev, the scattering is entirely due to the Coulomb potential. The interference term in the Mott scattering cross section of two identical particles can be seen as a rise in the cross section near 45°, illustrating the fact that nitrogen is a Bose-Einstein particle. The angular resolution is not sufficient to enable the precise measurement of the spin. At the higher energies the cross section drops below the Mott cross section at angles greater than 30°, due to the nuclear absorption of the particles as the apsidal distance approaches the sum of the two nuclear radii. At an energy of 21.7 Mev and an angle of 45°, the cross section is $\frac{1}{5}$ of the Mott cross section. A calculation which uses the strong absorption model of Blair, fits the differential cross section at 21.7 Mev quite well. In order to fit the data, the contributions from values of l up to 6 must be subtracted from the Coulomb cross section; this indicates that the nuclear radius of nitrogen is 40×10^{-13} cm^2. From this calculation the total nuclear absorption cross section for 21.7-Mev nitrogen on nitrogen is inferred to be 3.4×10^{-25} cm^2. (auth)

9662

CROSSING SYMMETRY IN MESON-NUCLEON SCATTERING. G. Feldman (Institute for Advanced Study, Princeton, N. J.) and P. T. Matthews (Univ. of Birmingham, England). Phys. Rev. 102, 1421-2(1956) June 1.

9663

THEORY OF NEUTRON SCATTERING BY CONDUCTION ELECTRONS IN A METAL AND ON THE COLLECTIVE-ELECTRON MODEL OF A FERROMAGNET. R. J. Elliott (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A235, 289-304(1956) May 8.

The cross-sections are studied for the magnetic scattering of slow neutrons by metallic electrons whose energy states are described by band theory. It is found that both electron spin and current contribute to the scattering. With the aid of certain simplifying assumptions numerical results are obtained for two cases, the free-electron model of a simple metal like sodium, and the collective-electron model of a ferromagnet with particular reference to specific experimental data on iron. Scattering takes place over wide angles and is very weak, although total cross-sections may be of the order of millibarns. Unfortunately, therefore, this technique cannot at present give much information about the electrons. The predictions of the collective-electron model of a ferromagnet are of importance for comparison with experiment and the predictions of the other models. It is here contrasted in detail with the spin-wave predictions. (auth)

9664

SPIN FLUCTUATION SCATTERING OF NEUTRONS AND THE FERROMAGNETIC STATE IN IRON. R. D. Lowde (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A235, 305-20(1956) May 8.

The theory and practice of neutron diffuse reflection which has been developed in earlier papers is here applied to the question: what theoretical model of ferromagnetism is most apposite in the case of iron? Experimental results on the response of diffusely reflected intensity to the magnetization of an iron crystal at room temperature and at 907°K are interpreted as excluding the collective-electron representation, and indicating that the Heisenberg-type, localized-electron model is much closer to the truth. From the fit obtained between the observations and the predictions of the localized-electron model it is suggested that the magnetic electrons in iron vibrate under thermal agitation with measurably less than the nuclear amplitude. (auth)

9665

ATTENUATION OF 86- AND 176-MEV SYNCHROTRON X-RAYS IN CONCRETE AND LEAD. William Miller and Robert J. Kennedy (National Bureau of Standards, Washington, D. C.). Radiation Research 4, 360-6(1956) May.

9666

FLUCTUATIONS DURING COLLISION OF HIGH ENERGY PARTICLES. M. I. Podgoretskii, I. L. Rozental' and D. S. Chernavskii (P. N. Lebedev Inst. of Phys.). Soviet Phys. JETP 2, 211-16(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 296-303(1955) Sept. (In Russian)

On the basis of the Fermi-Landau theory, the fluctuations in energy and number of particles during collisions of high energy nuclear-active particles are calculated. (auth)

9667

THE RADIATION OF A RAPIDLY MOVING ELECTRIC IMAGE OF A UNIFORMLY MOVING CHARGE. G. A. Askar'yan. Soviet Phys. JETP 2, 344(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 388(1955) Sept. (In Russian)

A calculation is made of the radiation caused by the change of the image of a charge with non-relativistic velocity falling on a conducting sphere. (B.J.H.)

9668

THE THEORY OF THE PROPAGATION OF GAMMA RAYS THROUGH MATTER. V. I. Ogievetskii. Soviet Phys. JETP 2, 312-19(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 454-63(1955) Oct. (In Russian)

The angular and energy distribution of gamma radiation is found as a function of depth of penetration into matter, for an initial energy of the order of several Mev. (auth)

9669

ANGULAR DISTRIBUTION OF GAMMA RAYS AT GREAT DEPTHS OF PENETRATION IN MATTER. V. I. Ogievetskii. Soviet Phys. JETP 2, 319-25(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 464-72(1955) Oct. (In Russian)

The angular and energy distribution of γ-rays at great depths of penetration in matter is found for the cases of constant and linear dependence of the absorption coefficient on wavelength. The passage of γ-rays through an inhomogeneous medium is examined. (auth)

9670

LOSS OF TWO ELECTRONS BY NEGATIVE IONS IN COLLISIONS WITH ATOMS AND MOLECULES. V. M. Dukel'skii and N. V. Fedorenko (Leningrad Physico-Technical Inst.). Soviet Phys. JETP 2, 307-11(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 473-8(1955) Oct. (In Russian)

The appearance of positive ions was detected in simple collisions of Cl^-, Br^-, I^-, Na^-, Sb^-, Bi^- and Sb_2^- ions (at an energy of 5 to 17.5 kev) with helium and argon atoms, and also with nitrogen and hydrogen molecules. They were formed by the loss of two electrons by the positive ions. The cross section for this process is about 10^{-17} to 10^{-16} cm^2. In the case of Sb_2^- and Bi_2^- ions, dissociation was observed with the appearance of not only negative but also of positive atomic ions. (auth)

9671

CALCULATION OF THE PHYSICAL DOSE OF γ RADIATION. THE DOSE FROM A POINT SOURCE. DETERMINATION OF THICKNESS OF THE PROTECTIVE LAYER. I. A. Kalinin and P. Ya. Vertebnyĭ. Zhur. Fiz. Khim. 30, 457-60(1956) Feb. (In Russian)

Based on the physical meaning of the x ray unit, an approximation expression has been developed for calculating the magnitude of the dosage intensity from a point source of radiation: $D = 5.6 \times 10^3 E_\gamma A\nu 1/l^2 r/h$, where E_γ is the energy in Mev of the γ quantum; A is the activity of the source in curies; ν is the amount of γ quanta per unit decomposition; l is the distance in cm. The expression holds for energy values of about 1 Mev and $l < 10m$. The absorption and scattering of γ quanta in thick air layers ($l > 10m$) has been accounted for by the factor $(1 + 0.6\,\mu l)\exp^{-\mu l}$, where μ is the absorption coefficient. The derived relationship has been used to calculate the required thickness of a protective material of concrete, iron, and lead. (tr-auth)

Refer also to abstract 9564.

RADIATION EFFECTS

9672 NAA-SR-1550

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EFFECT OF ELECTRON IRRADIATION AND QUENCHING ON THE WHITE-TO-GRAY TIN TRANSFORMATION. A. Sosin. Aug. 15, 1956. 8p. Contract AT-11-1-GEN-8. $1.80(ph OTS); $1.80(mf OTS).

Electron irradiation at approximately 78°K and quenching from 200°C have been found to have no effect on the white-to-gray tin transformation. These results may be compared with the accelerated rate of transformation following neutron irradiation at 78°K previously reported. It is suggested that dislocation loops are responsible for the neutron-induced acceleration. (auth)

9673

EFFECTS OF GAMMA RADIATION ON GERMANIUM. J. W. Cleland, J. H. Crawford, Jr., and D. K. Holmes (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 722-4(1956) May 1.

High-purity n- and p-type samples of Ge have been exposed to γ rays from a 900-curie Co^{60} source. The extrinsic electron concentration of n-type material decreases at a rate only $\sim 10^{-3}$ of that for fast-neutron irradiation. Two electron trapping levels which are apparently identical to those produced by fast neutrons have been observed. Extended exposure converts n-type material to p-type, indicating the presence of an acceptor level at ~0.26 ev above the valence band. This energy is somewhat larger than that found in material irradiated by fast neutrons. Interstitial clustering and nonuniform defect distribution are believed to lower the energy levels produced by fast neutrons; hence energetic photons apparently produce randomly distributed defects throughout the volume of the specimen. Exposure of p-type material causes a decrease in extrinsic hole concentration with a removal rate much less than that for n-type Ge. The cross section for atomic displacements obtained from these results is $\sim 1.5 \times 10^{-26}$ cm^2. This value is in reasonable agreement with the calculated cross section expected for the Compton electrons and photoelectrons produced by Co^{60} γ-ray absorption in Ge. (auth)

9674

SOME EFFECTS PRODUCED IN GRAPHITE BY NEUTRON IRRADIATION IN THE BNL REACTOR. W. L. Kosiba, G. J. Dienes, and D. H. Gurinsky (Brookhaven National Lab., Upton, N. Y.). pp.143-8 in Proceedings of the Conferences on Carbon, Univ. of Buffalo, New York, 1956.

The high concentration of lattice defects resulting from neutron bombardment in graphite produces important changes in the physical properties of this material. The following physical changes produced in graphite by irradiation in the Brookhaven reactor have been studied: 1) stored energy, 2) physical dimensions and 3) c-axis. These studies were made on samples exposed to an integrated neutron flux of $1.2-1.6 \times 10^{20}$ neutrons/cm^2. The temperature of exposure varied from 50°C to about 130°C. The results show that: 1) the stored energy (heat content) which was released at 200 and 400°C ranged from 0 to 50 cal/gm. 2) the physical dimensions increased from 0.09 to 0.18%. 3) the c-axis of the crystallites increased and this expansion was about nine times as great as the gross physical growth. 4) the changes in physical properties are more dependent on the temperature of irradiation than on the integrated flux at these levels of exposure. The effect of increasing the temperature of irradiation from 50 to 100°C is to decrease the changes in physical growth and c-axis expansion by about a factor of two. (auth)

RADIOACTIVITY

9675 AD-70911

Ohio State Univ., Columbus.

ORBITAL ELECTRON CAPTURE IN LANTHANUM^{137} (thesis). Michael David Lubin. 1955. 27p.

Radioactivity was studied in La^{137}, which results from the decay of the 1.5-day Ce^{137}. The Ce^{137} was produced by neutron irradiation of Ce enriched in the isotope of mass 136. Barium K x rays were observed and attributed to La^{137}. These x rays, and the fact that no other radiations were detected, indicate that La^{137} decays by K capture to the ground state of Ba^{137} in at least 97% of the disintegrations. The half life of the La^{137} is estimated to be 5.9×10^5 years on the basis of calculations involving the absolute counting rate, the neutron flux, amount of material used, and the neutron capture cross section of Ce^{136}. (auth)

9676

THE DOSE DISTRIBUTION FROM A CUP-SHAPED HOMOGENEOUS RADIATION SOURCE. Rolf Plesch. Strahlentherapie 99, 459-69(1956) Mar. (In German)

The author presents the mathematical development of formulas necessary for the calculation of the dose distribution of a cap-shaped homogeneous emitter and presents, in the form of a diagram, an adequate, practical scheme of calculation, the use of which is explained in connection

with an example. The complete course of the isodoses is shown for two further examples. Satisfactory conformity exists between the results of the calculation and the only hitherto existing measuring results of Becker and Scheer. (auth)

9677

METHOD FOR THE DETERMINATION OF ACTINIUM BY ITS ACTIVE DEPOSIT. Marguerite Perey and Andre Hettler. Compt. rend. 242, 2552-5(1956) May 23. (In French)

A very sensitive method of determination was used which allows the determination of $1/100^{e}$ μ curies of actinium, by means an active deposit precipitated in the presence of lead sulfate. The value of the activity of the deposit allows a direct determination of the millicurie value of an actiniferous product. (tr-auth)

9578

MODIFICATION OF THE COINCIDENCE METHOD APPLIED TO THE CALIBRATION OF RADIATION INTENSITY MEASUREMENTS FOR SOURCES BETWEEN 5 AND 50 μ CURIES. Simone Vuccino (Institut du Radium, Paris). J. phys. radium 17, 57-9(1956) Jan. (In French)

A study was made of the possibilities of the coincidence method applied to the absolute calibration of radiation sources between 5 and 50 μc. The principal sources of error are determined as well as the conditions which limit the precision of the method. A coincidence installation is described which has a resolving time of 3×10^{-7}s, and results are given for the calibration of Co^{60}, Sc^{46}, Na^{24}, Na^{22}, and Au^{198} sources above 10μc. (tr-auth)

9679

PREPARATION OF RADIOACTIVE SOURCES BY EVAPORATION AT HIGH TEMPERATURE. J. Merinis. J. phys. radium 17, 308-9(1956) Mar. (In French)

9680

MILLIGRAM Ra-EQUIVALENT OF SEVERAL γ EMITTING RADIOELEMENTS. S. Vuccino and J. Tobailem (Institut du Radium, Paris). J. phys. radium 17, 347-9(1956) Apr. (In French)

A determination was made of the milligram Ra-equivalents of the following γ emitting radioelements: Co^{60}, Cs^{137}, Sc^{46}, Na^{24}, and Cu^{64}, for two ionization chambers. The sources of these radioelements were measured with two chambers for comparison with a Ra standard. Their absolute intensity was determined by two methods: absolute direct measurement with the P. Savel ionization chamber; and comparison with weaker sources standardized with counters (coincidence method). The efficiency of the ionization chambers is given as a function of the emitted γ rays. (tr-auth)

9681

ON THE γ RADIATION OF Na^{25}. M. E. Nahmias and T. Yuasa (Coll. de France, Paris). J. phys. radium 17, 373-4(1956) Apr. (In French)

9682

STUDIES ON NATURALLY OCCURRING IONIZING RADIATIONS WITH SPECIAL REFERENCE TO RADIATION DOSES IN SWEDISH HOUSES OF VARIOUS TYPES. Bengt Hultqvist. Kgl. Svenska Vetenskapsakad. Handl. 6, No. 3, 1-125(1956). (In English)

A survey for α, β, γ and cosmic radiations in wood, brick and light-weight concrete containing alum shale was made. Instruments used and their calibration were included. (F.S.)

9683

COUNTING EFFICIENCY FOR Np^{239} BETA RAYS. Leon Wish (U. S. Naval Radiological Defense Lab., San Francisco). Nucleonics 14, No. 5, 102, 104, & 106(1956) May.

In a measurement of the absolute activity of Np^{239}, it is necessary to know the counting efficiency for Np^{239} activity. This measurement can be made by counting the α rays from the Pu^{239} daughter after the 2.3-day parent has decayed. (B.J.H.)

9684

DECAY OF In^{114m} AND In^{114}. Lee Grodzins and Henry Motz (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 761-5(1956) May 1.

Scintillation counter experiments have been performed on the 72-second activity of In^{114} produced by (p,n) and (d,2n) cyclotron bombardment of enriched Cd^{114} and on the 49-day activity of In^{114m} produced by neutron activation. The well-known 556-722-kev cascade radiation of Cd^{114} is shown to be excited by a K-capture transition from the 49-day isomeric level. The weak 1300-kev gamma ray previously assigned to Cd^{114} is shown to come from the first excited state of Sn^{114} and is in coincidence with a low-energy beta spectrum having an end point of 675 ± 40 kev. No gamma rays in Cd^{114} other than the 556- and 722-kev lines have been observed from the decay of In^{114m} or In^{114}. A 1.9% K-capture branch from In^{114} to the ground state of Cd^{114} has been found. A positron branch of ~0.004% between these two states is shown to have an end point of 400 ± 25 kev. (auth)

9685

DECAY OF IONIUM (Th^{230}). E. Booth, L. Madansky, and F. Rasetti (Johns Hopkins Univ., Baltimore). Phys. Rev. 102, 800-1(1956) May 1.

Gamma-ray coincidence studies of the decay of ionium yield the total conversion coefficient of the 68-kev gamma ray as $\alpha = 46 \pm 5$, and a value of $f = 0.52 \pm 0.05$ for the fluorescent yield from the L shell of Ra^{226}. The mean lifetime of the 68-kev state of Ra^{226} was found to be $T_{1/e} \leq 10^{-9}$ second. (auth)

9686

ELECTRON CAPTURE AND ALPHA DECAY OF Np^{235}. Richard W. Hoff, James L. Olsen, and Lloyd G. Mann (Univ. of California Radiation Lab., Livermore). Phys. Rev. 102, 805-7(1956) May 1.

The electron capture and alpha decay of Np^{235} have been investigated. An L/K capture ratio of 30 ± 2 is found from absolute L and K x-ray measurements. No gamma rays are observed in the electron capture decay of Np^{235}. An alpha branching ratio of $(3.5 \pm 0.4) \times 10^{-5}$ was measured for this nuclide. The alpha particles have coincident 26- and 85-kev gamma rays with an intensity of 0.054 ± 0.005 gamma per alpha disintegration for the 85-kev gamma ray. The intensity of the 26-kev gamma ray is comparable, although somewhat more uncertain. (auth)

9687

DECAY SCHEME OF Br^{82}. R. C. Waddell and E. N. Jensen (Iowa State Coll., Ames). Phys. Rev. 102, 816-23(1956) May 1.

The radiations from Br^{82} were studied using an intermediate-image coincidence spectrometer, gamma-gamma coincidence scintillation spectrometer, and gamma-gamma directional correlation equipment. One allowed β-ray group and eight γ were observed. An energy level diagram is proposed. Determinations of the energies, relative intensities, and internal conversion coefficients were made. Five directional correlation measurements were performed between various gamma-ray combinations. Unambiguous assignments for the spins and parities of four of the first five excited levels are made, while the assignment for the remaining level is restricted to two possible values. Multipole mixing ratios were measured for three of the transitions. A possible interpretation of the excited states, in terms of vibrational levels, is proposed. (auth)

9688

DECAY OF Ni^{66}. Noah R. Johnson, Raymond K. Sheline,

and Richard Wolfgang (Florida State Univ., Tallahassee). Phys. Rev. 102, 831-3(1956) May 1.

A study of the β and γ spectra of the nuclide Ni^{66} has been made. This isotope decays by a single beta ray of 0.20 ± 0.03 Mev, with no associated gammas, to the ground state of Cu^{66}. Both the log(ft) value and the shape of the Kurie plot indicate that this transition is allowed, thereby confirming the earlier spin and parity assignments of the ground state of Cu^{66}, and the 1.03-Mev excited level in Zn^{66}. (auth)

9689

DECAY OF Sb^{125}. N. H. Lazar (Oak Ridge National Lab., Tenn.). Phys. Rev. 102, 1058-62(1956) May 15.

Eleven gamma rays between 0.100 and 0.637 Mev have been identified in the decay of Sb^{125}. From their relative intensities as measured with a sodium iodide crystal 3 inches in diameter and 3 inches high, and with the assistance of coincidence spectrometry, a decay scheme may be constructed which is consistent with all the data. The half life for Sb^{125} was determined as 2.0 ± 0.2 years. (auth)

9690

PROPERTIES OF Bk^{245}. L. B. Magnusson, A. M. Friedman, D. Engelkemeir, P. R. Fields, and F. Wagner, Jr. (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 1097-1103 (1956) May 15.

The radiation of 5-day electron-capturing Bk^{245} were measured with electron spectrometer, scintillation spectrometer, and alpha pulse analyzer. Conversion electrons from 250-kev and ~390-kev transitions were observed. The electromagnetic spectrum contains L and K x rays and 250- and 380-kev gamma rays. The relative contributions to the x-ray intensities from the primary capture processes and from excited state conversions were determined by counting coincidences between the electromagnetic radiations. Bk^{245} decays primarily by electron capture (L/K = 0.33) to a 250-kev level in Cm^{245}. The K and L conversion coefficients of the 250-kev transition are 1.76 and 0.44, respectively, indicating that the transition is M1. About 6% branching decay goes to a level at 630 kev. The lifetimes of the excited states are less than 2×10^{-9} sec. The intensity of alpha-particle emission is 1.05×10^{-3} per disintegration (alpha half-life 13 yr). Three alpha groups were resolved: 5.89 Mev (26%), 6.17 Mev (41%), and 6.37 Mev (33%). (auth)

9691

BETA SPECTRUM OF Cl^{36}. R. G. Johnson, O. E. Johnson, and L. M. Langer (Indiana Univ., Bloomington). Phys. Rev. 102, 1142-8(1956) May 15.

The twice forbidden beta spectrum of Cl^{36} has been measured with a 4π scintillation spectrometer which is particularly well suited for measuring beta spectrum shapes from sources with low specific activity. The distribution was measured to as low as 89 kev with three sources of average thicknesses of 9, 19, and 20$\mu g/cm^2$. The data were analyzed by using the exact twice forbidden shape factor for the linear combination of the S and T couplings for $\Delta J = 2$. The ratios of nuclear beta moments appearing in the shape factor were treated as variable parameters. The best fit to the data was for $R_{ij}/T_{ij} = 0$ and $A_{ij}/T_{ij} = 14.2$. (auth)

9692

DISINTEGRATION OF Ge^{68}. Bernd Crasemann, D. E. Rehfuss, and H. T. Easterday (Univ. of Oregon, Eugene). Phys. Rev. 102, 1344-6(1956) June 1.

The isotope Ge^{68} has been prepared by the bombardment of zinc with 37-Mev alpha particles and separated chemically. The half-life of Ge^{68} is 275 ± 20 days, as determined by comparison with a Co^{60} standard over 10 months. The positron spectrum was measured with a thick-lens magnetic spectrometer. Positron groups from Ga^{68} have maximum energies of 1.94 and 0.92 Mev and relative intensities of 1 and 0.04, respectively; no positrons from Ge^{68} were observed above 0.3 Mev. The scintillation spectrum shows annihilation radiation and a 1.02-Mev gamma ray from Ga^{68} Comparison of areas under these two peaks, corrected for crystal efficiency, indicates that there are 14.4 ± 1.7 positrons per 1-Mev quantum. Within the probable error, this result is compatible with the decay of Ge^{68} by electron capture alone. (auth)

9693

DECAY OF Ce^{144}. Ira Pullman and Peter Axel (Univ. of Illinois, Urbana). Phys. Rev. 102, 1366-72(1956) June 1.

The decay scheme of 282-day Ce^{144} was investigated using a thin-lens beta spectrometer, proportional counters, and scintillation counters. Intensity measurements and coincidence studies were used to obtain the decay scheme. Two beta rays were found; the main branch is a 76%, 309 ± 5-kev beta ray to the ground state while the 24 ± 5%, 175-kev beta ray goes to a 134-kev level in Pr^{144}. From this level there are three parallel γ-ray branches: In 15.3% of the Ce disintegrations one observes a 134-kev gamma ray, in 7.2% a cascade of 81-kev and 54-kev gamma rays, and in 1.5% a cascade of 100 kev and 34 kev. For the conversion of the 134-kev gamma ray, $\alpha_K = 0.71 \pm 0.20$ and $K/L = 7.1 \pm 0.5$, while for the 81-kev gamma ray, $\alpha_K = 1.2 \pm 0.3$ and $K/L = 5.8 \pm 0.7$. There is insufficient intensity in the 54-kev gamma ray to explain observed coincidences, and a strong unobserved 42-kev gamma ray is implied. (auth)

9694

ON THE DECAY OF ^{202}Tl. P. Kramer, H. C. Hamers, and G. Jeijer. Physica 22, 208-12(1956) Mar.

The radiations from Tl^{202}, decaying by K and L electron capture, are investigated by different methods. The L/K capture ratio was found to be 0.9 ± 0.27. From this ratio, the suggested decay scheme, and the equation of Marshak, the total transition energy was found to lie between 0.54 and 0.75 Mev. (auth)

9695

CORRECTED MAXIMUM β-ENERGIES OF POSITRON-EMITTERS. A. H. W. Aten, Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Physica 22, 288(1956) Apr.

Maximum β^+ energies are tabulated for Ga^{65}, Ge^{67}, As^{70}, Sc^{73}, and Sb^{116}. (B.J.H.)

9696

INTERNATIONAL COMPARISONS OF RADIOACTIVITY STANDARDS. A. V. Astin (National Bureau of Standards, Washington, D. C.) and E. C. Bullard (National Physical Lab., Teddington, England) and W. B. Lewis (Atomic Energy of Canada Ltd., Chalk River, Ont.). Science 123, 895(1956) May 18.

International comparisons of standard samples of Na^{24}, P^{32}, Co^{60}, $Sr^{90} + Y^{90}$, I^{131}, and Au^{198} made during the period May 1952 to November 1954, show agreement within 1 or 2%. (L.M.T.)

9697

HANDLING ALPHA-ACTIVE, PYROPHORIC MATERIALS. PART 1. WHAT IS THE BEST APPROACH? Nucleonics 14, No. 3, 61-5(1956) Mar. PART 2. GLOVEBOX DESIGN AND CONSTRUCTION. Nucleonics 14, No. 4, 65-71(1956) Apr. PART 3. GLOVEBOX-ATMOSPHERE CONTROL. Nucleonics 14, No. 5, 77-82(1956) May. L. R. Kelman, W. D. Wilkinson, A. B. Shuck, and R. C. Goertz (Argonne National Lab., Lemont, Ill.).

A comprehensive discussion is given of the handling of α-active, pyrophoric materials. Part 1 includes discussions on the philosophy and rules of handling α emitters and descriptions of fuel element handling facilities. Part 2 surveys the design and construction of gloveboxes. The survey includes such topics as materials used, tightness, visibility, glove problems, and working with gloves. Part 3

discusses the atmospheric control in glove boxes. Included are topics such as the selection of an inert atmosphere, auxiliary equipment, and emergency ventilation. (B.J.H.)

Refer also to abstract 9715.

RARE EARTHS AND RARE-EARTH COMPOUNDS

9698
FINE AND HYPERFINE STRUCTURE OF PARAMAGNETIC RESONANCE IN DIVALENT EUROPIUM. A. A. Manenkov, and A. M. Prokhorov (Lebedev Inst. of Physics.). Doklady Akad. Nauk S.S.S.R. 107, 402-4(1956) Mar. 21. (In Russian)

Investigations are made of the paramagnetic resonance in Eu^{2+}. Two phosphor combinations with Eu as activator were studied—the phosphors SrS (Eu) in powder form and CaF_2(Eu) in monocrystal. Measurements were made on a superheterogenic radiospectroscope with frequency of 9341 Mc. Observations of lines were made on the screen of an electron-beam tube. The magnetic field was measured by proton resonance. Electronic transitions $M = \frac{1}{2} \leftrightarrow -\frac{1}{2}$, consisting of 12 superfine components, specified by the nuclear spin of two stable isotopes Eu^{151} and Eu^{153} were observed in SrS(Eu). Seven lines of superfine structure each consisting of 12 superfine components were studied in the CaF_2(Eu) monocrystal and the picture of CaF_2(Eu) total spectra is given. (R.V.J.)

9699
SPECTRA AND QUANTUM STATES OF THE EUROPIC ION IN CRYSTALS. I. ABSORPTION SPECTRUM OF ANHYDROUS EUROPIC CHLORIDE. Edward V. Sayre and Simon Freed (Brookhaven National Lab., Tenn.). J. Chem. Phys. 24, 1211-12(1956) June.

Anhydrous europic chloride and single crystals of europic chloride dissolved in a preponderant proportion of isomorphous $LaCl_3$ could be prepared so that they were sufficiently free of europous chloride to permit the study of their absorption spectra down to 3900 A. The crystal structure of these preparations was proved to be UCl_3 type through the use of a trace of praseodymium chloride as an internal indicator. Because this structure is so well substantiated and is free of the ambiguity inherent in the structure of hydrated salts, the spectrum of these crystals provides a secure basis for resolving the conflicting interpretations of earlier spectrum analyses. The polarized spectra indicate that lines in the yellow, green, and blue visible regions arise from upper states with J values of 0, 1, and 2 as proposed by Joos and Hellwege rather than J's of 0, 2, and 3 as proposed by Gobrecht. (auth)

9700
SPECTRA AND QUANTUM STATES OF THE EUROPIC ION IN CRYSTALS. II. FLUORESCENCE AND ABSORPTION SPECTRA OF SINGLE CRYSTALS OF EUROPIC ETHYLSULFATE NONAHYDRATE. Edward V. Sayre and Simon Freed (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 24, 1213-19(1956) June.

From the polarization properties of the fluorescence spectrum of single crystals of europic ethylsulfate nonahydrate it was possible to determine the multipole character of transitions, the energies and quantum nature of the seven levels of the ground state multiplet of the europic ion, and the group character of the sublevels into which these states are split by the crystal field. Such an analysis was made of all pure, uncoupled electronic transitions in the fluorescence spectrum. The analysis revealed that the rare earth ion is predominantly perturbed by a field of D_{3h} symmetry, arising from the water molecules of hydration immediately surrounding it. Upon this field is superimposed a weaker one of lower symmetry, C_{3h}, arising from the lattice as a whole. All transitions involving a change of J of one appeared as magnetic dipole radiation. All others appeared as forced electric dipole transitions, including one which would have been fully allowed as a magnetic dipole transition. A similar analysis of the absorption spectrum in the near ultraviolet was only partially successful because of the superposition of the split levels of some of the upper states. It was in accord with the analysis of the fluorescence spectrum and from it was determined the multipole nature of the transitions and the quantum nature of some of the more isolated upper states. (auth)

9701
ISOTOPIC SHIFT IN Gd SPECTRA. Hans Kopfermann, Lorenz Krüger, and Andreas Steudel. Naturwissenschaften 43, 175-6(1956) Apr. (In German).

Refer also to abstract 9182.

SHIELDING

Refer also to abstract 9671.

SPECTROSCOPY

9702 OORTM-55-2
Tennessee. Univ., Knoxville.
BASIC THEORIES OF INFRARED SPECTRA. Alvin H. Nielsen. Dec. 1955. 33p. Contract DA-33-008-ORD-1166.

9703
CORRECTIONS FOR X RAY SPECTRA DISTORTIONS INTRODUCED BY INSTRUMENTS. M. A. Blokhin (Molotov Rostov-on-Don State Univ.). Doklady Akad. Nauk S.S.S.R. 107, 229-32(1956) Mar. 11. (In Russian)

A method of finding the true form of x-ray spectra in distortions of dispersion type was previously reported by the author. A mathematical analysis, based on the previous work, is offered for finding and correcting the x-ray spectra of any form of distortion. To reveal the character of distortion, a line, lying as close to the investigated region of spectrum as possible, is selected, and its true form and width determined on a binary-crystal spectroscope. Such line is accepted as the "standard" line. If the line is not of dispersion form then the distortion caused by the instrument is not of dispersion character. In general cases, distortions can be of asymmetric form. In processing the absorption spectra the corrections to obtain the true form of the spectrum are made on the curve distribution of intensities. With the corrected spectral form, a curve is plotted for distribution of the coefficient of absorption. The last curve can be corrected again for the width of the internal level. (R.V.J.)

9704
ROENTGEN SPECTRA AND ELECTRON STRUCTURE OF Th IN COMBINATION OF $Th(NO_3)_4$ AND ThO_2. R. L. Barinskiĭ. (Laboratory of Mineralogy and Geochemistry of Rare Elements). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 133-5(1956) Jan. (In Russian)

An x-ray spectral method was used in the study of electron structure of atoms in the solid state. $M_{iv,v}$ spectra of absorption and emission of Th of two solid crystal line compounds of $Th(NO_3)_4$ and ThO_2 were investigated. The work was made on an x-ray spectrograph with a quartz crystal (constant d = 3.33 A) bent on radius of 500 mm. The dispersion of the instrument on the wave length of Th $M_{iv,v}$ boundary of absorption was $10 \times E$ mm^{-1}(9eV mm^{-1}). Continuous spectra were obtained from an x-ray tube with tungsten anode of 10kv with current up to 50 ma. Spectra of Th emission in the compounds were obtained by the method of initial excitation. Spectra were recorded photographically

on a fine-grained positive film, with exposures from 1.5 to 10hr. A visual microphotometer was used to develop the 5 spectrographs taken for each spectrum. Diagrams of Th and $Th(NO_3)_4$ M_{IV}-and M_V-absorption spectra and the Th emission lines are given. The studies established a negligible difference in the structures of excited 5f levels of Th in ThO_2 and $Th(NO_3)_4$. The strong density of free p-states in the first compound and weakened center of gravity in 5f levels, lead one to assume that the ion-type bond in ThO_2 is weaker than in $Th(NO_3)_4$. The type of bond in this group is similar to the "uranyl bond". In every other respect M_V-spectra of $Th(NO_3)_4$ and ThO_2 are quite analogous to the spectra of U^{4+}. (R.V.J.)

9705

NEW VACUUM ROENTGEN SPECTROGRAPH RSD-2. K. I. Narbutt, E. E. Vainshtein, A. B. Gil'varg, and L. M. Belyaev (Inst. of Crystallography). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 152-60(1956) Jan. (In Russian)

Previous works described the technology of bending large size crystals which increase the resolving power of spectrographic instruments. On this basis a powerful spectrograph RKS-3 was built for short-wave spectra with photographic recording. The new RSD-2 spectrograph is one of the new series of instruments built with the increased resolving power which has recently been developed, for the long-wave area of x-ray spectra in which spectral lines of K-series elements from K to Cu and L-series elements from Ag to Ta inclusive, are resolved. The spectrograph can be used for the x-ray spectral method of elementary analysis of a substance, as well as, for analysis of thin structural lines of emission, and boundary absorption. A detailed description of the design is given. (R.V.J.)

9706

IMPULSE METHOD OF MEASURING LIGHT ION SPECTRA IN ATMOSPHERE. L. R. Tsvang (Inst. of Geophysics). Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. 202-9(1956) Feb.

A new method of measuring ion spectra in atmosphere, a theory of the method applied for flat cylindrical condensers, and a short description of the apparatus designed for the new method of measurement are given. (tr-auth)

9707

THE VIBRATION-ROTATIONAL SPECTRUM OF METHYL-d_3 FLUORIDE. Walter F. Edgell and L. Parts (Purdue Univ., Lafayette, Ind.). J. Am. Chem. Soc. 78, 2358-62 (1956) June 5.

The Raman and infrared spectra of methyl-d_3 fluoride have been obtained. The Q sub-band structure of the perpendicular bands was resolved and lead to the values 2258.0, 1073.3 and 911.0 for the "apparent" band centers and 0.179, −0.286 and 0.241 for the Coriolis coupling constants of ν_4, ν_5 and ν_6, respectively. (auth)

9708

DETERMINATION OF ACCURATE WATER VAPOR CALIBRATION POINTS FOR PRISM SPECTROMETERS IN THE REGION 1330-2100 cm^{-1}. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 24, 1250-2(1956) June.

The spectrum of water vapor in the region 1330 to 2100 cm^{-1} has been observed with a CaF_2 prism in a Perkin-Elmer double-pass spectrometer. A Friedel-McKinney equation [D. S. McKinney and R. A. Friedel, J. Opt. Soc. Am. 38, 222 (1948)] was used to determine the water vapor frequencies. Many of these water vapor frequencies are presented as the best available calibration points in the 1300 to 2100 cm^{-1} region, accurate to ±0.3 cm^{-1}. (auth)

9709

SODIUM CHLORIDE AND CALCIUM FLUORIDE WINDOWS FOR HIGH-PRESSURE INFRARED SPECTROSCOPY. R. W. Parsons and H. G. Drickamer (Univ. of Illinois, Urbana). J. Opt. Soc. Amer. 46, 464(1956) June.

In spectroscopic studies of liquids under pressure, windows of synthetic sapphire were used successfully to 12,000 atmospheres pressure. NaCl windows extruded too rapidly and deformed badly at 2000 atmospheres. CaF_2 windows permit a single exposure at 11,000 atmospheres; it is possible that they might be used 2 or 3 times at 4000 atmospheres. (F. S.)

Refer also to abstracts 9187, 9188, 9190, 9699, 9700, and 9719.

THEORETICAL PHYSICS

9710

ON THE APPLICABILITY OF THE FERMI EXPRESSION FOR DESCRIBING POLARIZATION OF FAST NUCLEONS DURING SCATTERING BY NUCLEI. I. I. Levintov (Inst. of Chem. Physics). Doklady Akad. Nauk S.S.S.R. 107, 240-3(1956) Mar. 11. (In Russian)

9711

THE PROBLEM OF BOUND STATES AND THE MODEL OF NUCLEAR INTERACTION BY MESON PAIRS (WENTZEL'S MODEL). E. Arnous (Institut Henri-Poincare, Paris). J. phys. radium 17, 107-11(1956) Feb. (In French)

9712

THEORY OF ORDER-DISORDER KINETICS. George H. Vineyard (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 102, 981-92(1956) May 15.

The problem of relating fundamental atom movements to the change of the state of order of an alloy is attacked in a basic manner by introducing an infinite array of distribution functions for the occupation of all possible sets of lattice sites. These distribution functions determine all the kinds of order in the lattice, including the usual long- and short-range order. They are shown to obey general equations of motion which are linear and in which the kinetic parameters of atom movements occur as coefficients. Solutions of the equations of motion must be found by approximations, and a variety of possible procedures are suggested. These depend on expressing higher order distribution functions by combinations of those of lower order. The simplest of these procedures is explored in detail for two mechanisms of atom movement, direct interchange and vacancy interchange, and for two common lattice types, AB b.c.c. and AB_3 f.c.c. The result is a calculation of the time dependence of long-range order in homogeneous systems, and is expected to be reliable whenever the long-range order is reasonably high. The simple theory leads to the Bragg-Williams result at equilibrium, and gives a fundamental derivation and limitation of the conception that ordering is a "chemical reaction" of the type $A^{\alpha} + B^{\beta} \rightleftharpoons A^{\beta} + B^{\alpha}$. The vacancy and direct interchange models lead to qualitatively similar, but not identical results. Present evidence suggests predominance of the vacancy mechanism, at least in close-packed systems. The simple vacancy model is applied to experiments of Burns and Quimby on electrical resistivity in Cu_3Au. The observed relaxation times, over a range of temperatures below the critical temperature, are in reasonably good accord with theory when parameters derived from diffusion measurements in Cu and Au are employed. (auth)

9713

THERMODYNAMICS AND THE OVERHAUSER NUCLEAR POLARIZATION EFFECT. W. A. Barker and A. Mencher (Swiss Federal Inst. of Tech., Zurich). Phys. Rev. 102, 1023-9(1956) May 15.

A thermodynamical treatment by Brovetto, Cini, and Ferroni of the Overhauser effect in metals and non-metals

is extended to apply to nuclear relaxation processes other than that due to the contact interaction. Justification for the method is then presented by an application of the theory of the thermodynamics of irreversible processes using the point of view of the Onsager relations. According to a condition obtained for the validity of the method, the expressions derived for the population of adjacent nuclear Zeeman levels for Boltzmann and for Fermi statistics for the electrons hold essentially over the entire range of field and temperature at which the related experiments may be performed. Perturbation theory is applied to the case of several nuclear relaxation mechanisms, and the results are shown to agree with the thermodynamical results to second order in a power series expansion. A calculation of the small effect of the nuclear-electron dipolar interaction in reducing the Overhauser effect in metallic lithium is reported. (auth)

9714

GENERAL THEORY OF SPIN-WAVE INTERACTIONS. Freeman J. Dyson (Univ. of California, Berkeley and Institute for Advanced Study, Princeton, N. J.). Phys. Rev. 102, 1217-30(1956) June 1.

An ideal model of a ferromagnet is studied, consisting of a lattice of identical spins with cubic symmetry and with isotropic exchange coupling between nearest neighbors. The aim is to obtain a complete description of the thermodynamic properties of the system at low temperatures, far below the Curie point. In this temperature region the natural description of the states of the system is in terms of Bloch spin waves. The nonorthogonality of spin-wave states raises basic difficulties which are examined and overcome. The following new results are obtained: a practical method for calculating thermodynamic quantities in terms of a nonorthogonal set of basic states; a proof that in 3 dimensions there do not exist states (shown by Bethe to exist in a one-dimensional chain of spins) in which two spins are bound together into a stable complex and travel together through the lattice; a calculation of the scattering cross section of two spin waves, giving a mean free path for spin-spin collisions proportional to T^{-5} at low temperatures; and an exact formula for the free energy of the system, showing explicitly the effects of spin-wave interactions. Quantitative results based on this theory will be published in a second paper. (auth)

9715

COUPLING CONSTANTS IN THE THEORY OF β DECAY. M. A. Preston and Kailash Kumar (McMaster Univ., Hamilton, Ont., Canada). Phys. Rev. 102, 1347-8(1956) June 1.

Certain symmetry arguments have been used to suggest that the beta-decay interaction is S – T + P. It is shown that if the negative electron in these arguments is replaced by the positron, the result is S + T + P and that the proposed symmetries do not lead to Hermitian Hamiltonians which treat negatrons and positrons on the same footing. (auth)

9716

REPRESENTATION OF CHARGE CONJUGATION FOR DIRAC FIELDS. B. P. Nigam and L. L. Foldy (Case Inst. of Tech., Cleveland). Phys. Rev. 102, 1410-12(1956) June 1.

Explicit representations of the charge conjugation transformation for fermion fields are derived in a form which does not make explicit reference to the expansion of the fields in a complete orthonormal set of space and spin functions. It is shown that the different forms must be equivalent if one is working in an irreducible representation of the Wigner-Jordan anticommutation rules, but it has not been found possible to prove the equivalence directly, thus suggesting that the representations are not equivalent if the representation of the anticommutation relations is not irreducible. The results are applied to the clarification of an apparent paradox concerning commutability of the charge conjugation and space inversion transformations. (auth)

9717

ON PARTICLE ENERGY DISTRIBUTION AT MULTIPLE FORMATION. N. M. Gerasimova and D. S. Chernavskii (P. N. Lebedev Inst. of Phys.). Soviet Phys. JETP 2, 344-6 (1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 372-4(1955) Sept. (In Russian)

The justification for disregarding wave motion in the calculation of particle angular and energy distribution is discussed. (B.J.H.)

9718

THE PROBLEM OF THE ASYMPTOTE OF THE GREEN FUNCTION IN THE THEORY OF MESONS WITH PSEUDOSCALAR COUPLING. E. S. Fradkin (P. N. Lebedev Inst. of Phys.). Soviet Phys. JETP 2, 340-2(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 377-9(1955) Sept. (In Russian)

TRITIUM AND TRITIUM COMPOUNDS

9719

INFRARED SPECTRA AND MOLECULAR CONSTANTS OF GASEOUS TRITIUM BROMIDE AND TRITIUM CHLORIDE. Llewellyn H. Jones and Eugene S. Robinson (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 24, 1246-9(1956) June.

The infrared spectra of TCl^{35}, TCl^{37}, and $TBr^{79,81}$ have been observed using a CaF_2 prism. A least squares treatment of the data yielded the following molecular constants for $TBr^{79,81}$ (the notation of $TBr^{79,81}$ indicates the natural isotopic mixture of Br^{79} and Br^{81}), TCl^{35}, and TCl^{37} respectively: ν_0 = 1519.26, 1739.10, and 1735.51 cm^{-1}; B_e = 2.899, 3.746, and 3.723 cm^{-1}; α_e = 0.046, 0.061, and 0.066 cm^{-1}; and $D_e = 4.5 \times 10^{-5}$, 7.7×10^{-5}, and 6.8×10^{-5} cm^{-1}. (auth)

URANIUM AND URANIUM COMPOUNDS

9720

EFFECT OF PARTICLE SIZE ON BULK DENSITY AND STRENGTH PROPERTIES OF URANIUM DIOXIDE SPECIMENS. M. D. Burdick and H. S. Parker (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc. 39, 181-7(1956) May.

Fused UO_2 was separated into fractions of varying particle size by air separation. Specimens of the nominal size of $\frac{1}{8}$ by $\frac{1}{4}$ by $1\frac{1}{2}$ in. were formed by hydrostatic pressing, firing, and lapping. Specimens prepared from the 0 to 5 μ fraction were the strongest and most dense. The room-temperature density was about 92% of theoretical and the room-temperature flexural strength was about 12,000 lb/in.^{2}. When tested at 1000°C., the strength was about 18,000 lb/in.^{2}. The flexural strength of specimens decreased and their density decreased as the starting particle size was increased. The crystallization of the urania fragments which had occurred during the firing treatment was observed. (auth)

9721

MAGNETIC PROPERTIES OF BETA-URANIUM HYDRIDE. S. T. Lin and A. R. Kaufmann (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 102, 640-6(1956) May 1.

A thorough magnetic investigation of beta-uranium hydride has been carried out. The curve of reciprocal paramagnetic susceptibility against temperature generally follows the Curie-Weiss law and shows the same curvatures near the Curie point and at high temperatures as do the data for the ferromagnetic elements above their Curie points. A considerable number of magnetization curves have been ob-

tained for a wide range of temperatures. Three methods were used for deducing the spontaneous magnetization for comparison. The curve of reduced spontaneous magnetization against reduced temperature lies very close to the curves of iron, nickel, and cobalt. The paramagnetic Curie temperature, 173°K, is about 8°K lower than the ferromagnetic Curie point. The number of electron spins per molecule obtained from the saturation magnetization and from the temperature dependence of the paramagnetic susceptibility shows the same discrepancy as do the ferromagnetic elements. Three hysteresis loops at about 161.1°K, 75°K, and 4.2°K and the coercive forces from about 170°K down to 4.2°K have been obtained. The magnetocrystalline anisotropy constants for the whole low-temperature range calculated from the magnetization curves and from the coercive forces agree in order of magnitude. (auth)

9722

INVESTIGATION OF THE ISOTOPE EFFECT IN THE URANIUM SPECTRUM. A. R. Striganov and L. A. Korostyleva. Soviet Phys. JETP 2, 277-89(1956) Mar. (In English). Zhur. Eksptl.' i Teoret. Fiz. 29, 393-405 (1955) Oct. (In Russian)

The isotope shift in the spectrum of uranium has been measured for 346 lines among the components of the isotopes U^{238} and U^{235}. The regularities obtained in the isotope shift have been employed for the extension of the classification of the uranium spectrum and for the establishment of the isotope shift in several terms of U I and U II. Starting from the shift of the terms $5f^47s^6l_{\frac{9}{2}}$ and $5f^37s^2\ {}^4l_{\frac{9}{2}}$, it is found that the lowest electron configuration of U II is $5f^47_{\frac{1}{2}}$. (auth)

Refer also to abstracts 9183 and 9618.